Spinal Caries

NOBLE SMITH.

With the Author's Compts.

SPINAL CARIES.

(SPONDYLITIS OR INFLAMMATORY DISEASE OF THE SPINAL COLUMN.)

BY

NOBLE SMITH, F.R.C.S.Ed., L.R.C.P.Lond.

SURGEON TO THE CITY ORTHOPÆDIC HOSPITAL;
SURGEON TO ALL SAINTS' CHILDREN'S HOSPITAL;
ORTHOPÆDIC SURGEON TO THE BRITISH HOME FOR INCURABLES.

London
SMITH, ELDER & CO., 15, WATERLOO PLACE
1894

PREFACE.

In writing the following pages I have endeavoured to make my remarks as practical as possible, recording my own experiences chiefly, but also referring, where I have thought it desirable, to cases recorded by other surgeons.

The drawings I have made myself, in many instances from photographs, and in others from sketches which I had previously made in my note books. Nearly all the representations of pathological specimens have been drawn by me during my visits to the metropolitan museums, and I have further traced and drawn in ink all these subjects for the ultimate blocks, so that if any misrepresentation occurs, I alone am responsible.

However, having taken great care to follow the salient points, I hope I have in all cases correctly represented the subjects before me, whether these have been patients, or morbid preparations found in museums.

Noble Smith.

Queen Anne Street,
London, W.,
May, 1894.

CONTENTS.

The influence of Actinomycosis upon the production of Caries will be considered in a subsequent edition.

SPINAL CARIES

(SPONDYLITIS, OR INFLAMMATORY DISEASE OF THE SPINAL COLUMN).

CHAPTER I.

SPINAL CARIES (SPONDYLITIS).

In the following chapters I have discussed the nature of caries of the spinal column and its treatment, and have also shown that, in a great many instances of its occurrence, the symptoms are obscure and liable to mislead us in our diagnosis.

The most experienced surgeon may have a difficulty in determining the real nature of the case, not only in the very early stages, but even when the disease has made considerable progress, for it sometimes happens that the signs commonly, or exceptionally attributed to caries are absent, or that other symptoms mask those pertaining to this disease. In the early stages especially, there is often a difficulty in detecting the nature of the case, and this applies both to children and adults.

In the treatment of obscure cases it is well to act with caution, and adopt a method of treatment which at least is not calculated to increase the disease should it happen to be that which we are now considering. In respect to this subject I would especially refer the reader to p. 65 *et seq.*

There are several affections of the spinal column which we

may consider allied to caries—allied at least as far as symptoms are concerned, and as being also of an inflammatory nature. Various forms of traumatic injury; strains, contusions, partial fractures, and inflammatory affections following severe illnesses and causing much pain. The latter condition occurs so often after typhoid fever, that Dr. Gibney of New York has described such cases as "typhoid spines," considering that their pathology is one of periostitis (see p. 78). Whether any of these various conditions may eventually produce caries is a subject upon which there are differences of opinion, but at least we know that in patients thus affected pain may continue month after month unrelieved by medicinal remedies, whereas they succumb to prolonged fixation of the painful parts, or, in other words, to application of the treatment suitable to caries.

In considering this point we must remember the many instances, some of which I record in this volume, where the history of the patients has been either of the character to which I have just alluded, or even of a less definite form, and in which after death a very extensive degree of caries has been found. Dean Buckland, the author of one of the Bridgewater treatises, and the father of the late Frank Buckland the eminent and popular naturalist, suffered from symptoms which were attributed by his friends to melancholia, but nevertheless he died from caries (see p. 67).

Some of the cases recorded as obscure showed symptoms which would, I think, have been recognised by the surgeon if he had realized the variety of the characters which may present themselves in caries. Some of these I have referred to under "Cases."

There are other diseases of the spine which may simulate caries, and which will be helped in their treatment by careful mechanical fixation. Some of these are:—

Rheumatoid Arthritis, which may attack the spine and cause great suffering.

Rickets, which may give rise to difficulties in diagnosis, and even produce paralysis from direct bony pressure.

Cancer, Hydatids, Aneurism causing pressure upon the spine; and some other affections which are also mentioned below.

In this consideration we cannot exclude **Lateral Curvature,** from softness of bones and relaxation of ligaments, un-

associated with inflammation. This affection is one which I discuss in the following pages very fully, showing how difficult or impossible it may be to form a certain opinion, and how important it is to adopt a careful treatment and not jeopardise the patient by prescribing exercises and free movements until the diagnosis is absolutely certain. In this matter of diagnosis I would especially call attention to the test of temperature—a test which is not always applied (see p. 38.)

Other diseases affecting the form of the spine, such as Osteo-malachia and Spondylolisthesis I have not dealt with, fearing to enlarge the volume too greatly.

Caries of the Spine is very prevalent among children, is not uncommon in adult life, and sometimes occurs even in old age. It is an inflammatory disease of the vertebral bones, and of the inter-vertebral fibro-cartilages, progressing to a process of ulceration by which the affected parts are gradually dissolved away. An abscess is usually formed at the seat of inflammation, and is at first out of sight at the front of the spine, but it may extend in various directions according to the part of the column affected, appearing externally at the side of the neck or in the back, thighs, or elsewhere, sometimes opening internally into the bowels or other viscera.

If this inflammatory process is allowed to continue unchecked, it will extend in time to the spinal cord, producing at first weakness, and ultimately paralysis of the legs, or even involving more or less of the body, but only including that part which is below the seat of the disease. While these symptoms are developing, the general health of the patient is deteriorating, and although, in the early stages, he may feel comparatively well, and even have a robust appearance, the strength of the body is gradually undermined, until at last the patient sinks from exhaustion caused by the continued pain, the incessant discharge of pus, or from secondary disease of the liver, kidneys, or other organs.

This progressive downward course ought never to occur, unless it be in the case of patients who are suffering from some severe constitutional disease, or whose general condition of vitality, irrespective of the caries, is too feeble to resist any further strain.

Before the year 1779, all sorts of curvatures of the spine were confused together, and Percival Pott was the first surgeon to draw a clear distinction between curvature caused by the disease under consideration, and other kinds such as those usually denominated "lateral." So commonly did the disease at that period progress unchecked, until paralysis of the body below the part affected took place, that Pott entitled his work "Remarks on Palsy of the Lower Limbs

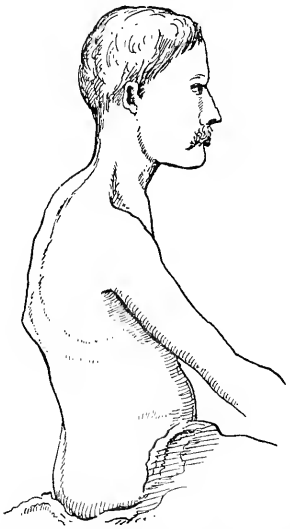


FIG. 1.

A typical form of Caries of the Spine.

found to accompany Curvature of the Spine," &c. The description given by Pott, which described caries as a distinct disease, was in time acknowledged as correct, and the term "Pott's disease" has since been very commonly used in describing this condition. Another familiar term is "Angular Curvature," and this is used in contradistinction to "Lateral Curvature." The term "Angular Curvature" has been objected to because an angle is not a curve, but I would rather object to it because so many cases of the disease occur where the deformity is not an angle. In the typical case, however, the

spine ultimately projects in an acute angle, and we may then without any difficulty form our diagnosis of the nature of the affection.

But the spine may be bent backwards in a bow, as in fig. 2. It may take a quadrilateral form, as in fig. 3. The projection may be obscured by the disease being situated in the lumbar region, when, instead of the natural incurvation of this part, there may be simply an absence of it, and perhaps some slight prominence of the spinous processes upon palpation, or in

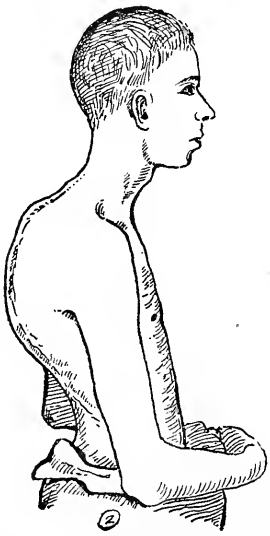


Fig. 2.
General roundness of back in caries.

the cervical region where the same effect may be produced. Again, there may be a lateral angle or curve caused by the disease attacking one or other side of the spinal column, this being distinct from the lateral deflexion of the spine in the early stages, the effect of muscular spasm, a subject that is fully dealt with at p. 14. There may be no deformity whatever, as occurs when the caries attacks limited parts of the vertebræ, so that the spinal column is not displaced. Even other modifications of form caused by this affection may

occur, so that it is better to discard the name "angular," notwithstanding its indicating the shape of the deformity commonly found in cases of this disease.

Spondylitis is the term used in America, and it is undoubtedly a very good one. However, **Spinal Caries** is also a scientific name, and clearly indicates the nature of the affection, and for these reasons I have adopted it as a title to this volume. The illustrations given above are those of ad-

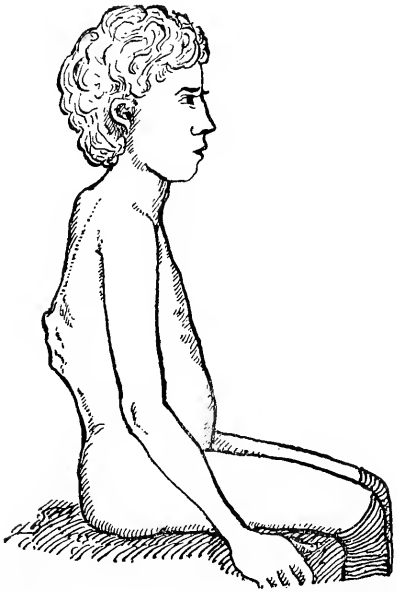


FIG. 3.
Quadrilateral deformity.

vanced cases of disease in which there is never any difficulty in recognising the nature of the affection, but there are a very large number of instances in which the diagnosis is more difficult, either from absence or slightness of deformity, slow progress of the inflammatory changes, or from the similarity of the symptoms to those of other affections. I have met with quite a notable number of patients who have thought themselves to be suffering from rheumatism in the

form of lumbago, or from neuralgia, or from some functional disorder, while their troubles have been entirely due to caries of the spinal column. Before proceeding further it may be

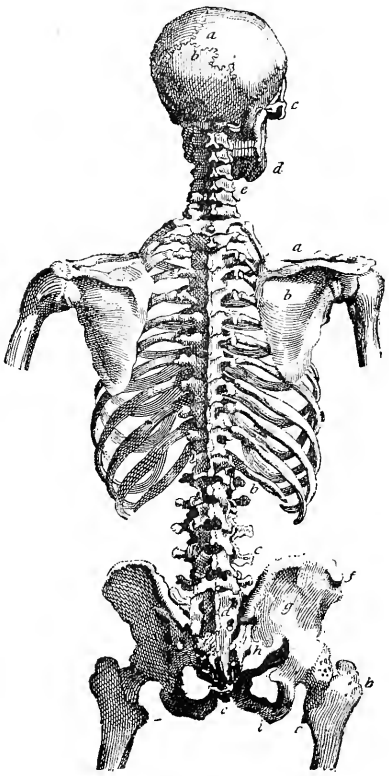


FIG. 4.

Posterior view of the spine and pelvis.

well to consider the general anatomy of the parts we have to deal with.

The Spinal Column may be described as consisting of a foundation formed by the wedge-shaped sacrum (see fig. 4,) firmly fixed into the pelvis (*g*). Erected upon this base are 24 bones, interlocked at their posterior parts, *the arches*, by closely adapted joints, and separated from one another an-

teriorly by elastic fibro-cartilages, all these bones being strongly united together by ligaments.

The spinal column can be moved anteriorly, posteriorly, or laterally, by the muscles which are attached to it, or these

FIG. 5.
The spine seen laterally, the natural curves being shown.

movements may be combined in circumduction The whole spine can also be rotated upon its own axis.

In rotation the front of the first cervical vertebra may turn towards one or other side; but the movement is chiefly between the two first vertebræ, and those below move in a much less degree. But to whatever extent the whole cervical portion of the spine turns, the effect is produced by each vertebra twisting very slightly upon the one below it.

The muscles of the spine are brought into action for a great variety of purposes. Besides the varied movements of the column itself, many actions, ordinarily supposed to belong entirely to the extremities, take a direct basis from the spine; and in order to use muscles which have no direct communication with the spine, others, which are attached to this column, must often be in the first place "fixed," *i.e.*, set in action and so retained.

It must further be remembered that the muscles of the back are very extensive and complicated in their attachments, so that all the varied movements, which have been referred to above, can be carried out by them. In fact, the muscles, if sufficiently exercised, are capable of performing a greater degree of movement than the ligaments of the spine will ordinarily allow.

The Undeveloped Spine.—The foregoing brief description refers chiefly to the fully developed spine—the spine of the adult. As we meet with disease and distortion very often at an early period of life, before the spine is fully developed, it is desirable to consider the condition of the column during its period of growth. It will be remembered that at birth each vertebra consists of three bones, united by cartilage. The osseous laminæ unite behind during the first year, and the body is joined to the arch about the third year. The centres of ossification for the transverse and spinous processes do not appear until the sixteenth year, and those which form the thin plates at the upper and under surfaces of each body of a vertebra not until the twenty-first. All these parts are not thoroughly joined together, and the bones completely formed, until the thirtieth year of life.

The spine, during this period of growth, is more susceptible to injury and deformity than after it is fully formed; but it may be reiterated that there is no age at which it is free from the disease we are considering. Besides being the basis of support

for the body, the spinal column has a very important function to perform in surrounding that important nerve centre, the *spinal cord,* and protecting it from injury. From the spinal cord proceed the nerves, emerging between the junctions of the vertebræ, to supply the whole of the body with nerve influence. In caries of the spine, extension of inflammation from the bones

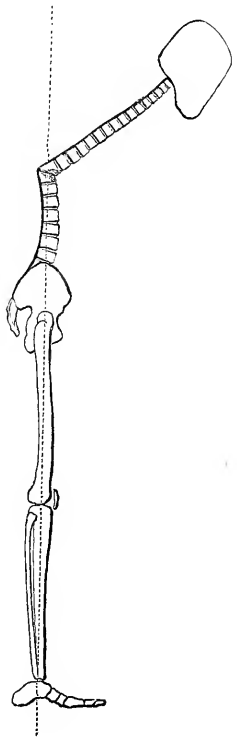


Fig. 6.

to the spinal cord, or pressure upon the cord or nerves from the products of inflammation, are the causes of derangements of the functions of the various organs of the body from interference with their nerve supply. This interference causes a great variety of results, including pain, irritation, functional disorder, and paralysis.

Development of the Deformity.

The projection popularly called "the growing out" of the spine is the most obvious deformity of this disease, and although there are many cases in which such deformity does not exist, or in which it is very slight, yet it is characteristic of the majority of the instances of caries, and therefore we had better now consider the manner of its production.

Caries usually commences in the front parts of the column, and extends backwards, but seldom attacks the arches of the

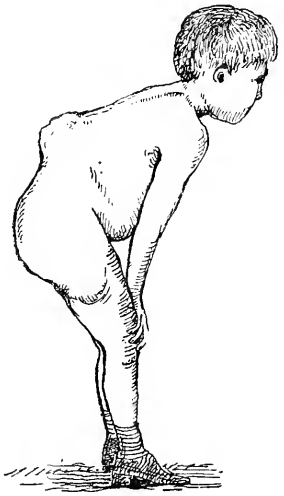


Fig. 7.

vertebræ. The superincumbent weight of the body is supported chiefly upon the parts of the bones which lie in front of the spinal cord—the bodies of the vertebræ—and consequently as the inflammatory process proceeds, and the bone is dissolved away, the trunk of the patient bends forwards, and the ulcerated surfaces of bone fall together. Fig. 6 indicates this condition.

The arches and spinous processes are not drawn, but the figure shows the disposition of the upper part of the body to fall forwards, and for the spine to project backwards. The

position shown in this figure is not maintained by the patient, as the centre of gravity would be thus thrown too far forwards, so that he must either bend his knees and throw the lower part of the spine backwards, as in fig. 7, or he must hold his

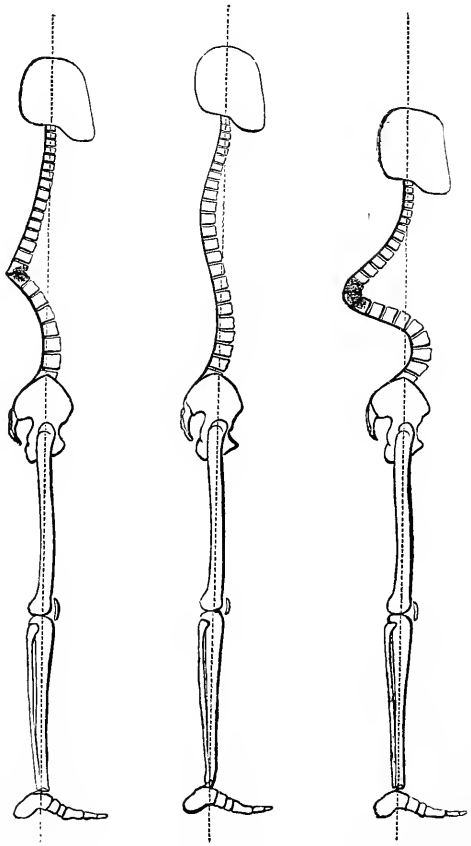


Fig. 8. Fig. 9. Fig. 10.

head more erect, and let the vertebræ above and below the point of disease accommodate themselves to this position.

Fig. 8 shows the latter position, and when compared with fig. 9, which delineates the natural contour of the spine, it will be seen that the diseased part is thrown backwards to allow

the diseased surfaces of bone to remain in apposition. As a rule patients do not hold themselves quite so upright as indicated in fig. 8, but they stoop somewhat while keeping their heads sufficiently within the line of gravity. When even this position is painful or insupportable, the patient stoops more and keeps himself from falling forwards by resting on a chair or other support (fig. 11), or by placing his hands on his knees as in fig. 7.

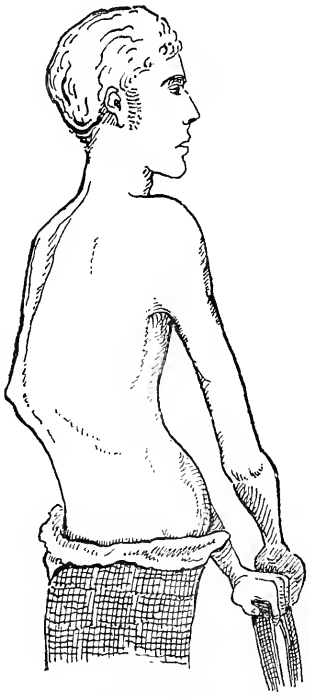


Fig. 11.

When the disease attacks several bones in conjunction, the projecting part is less angular, as shown in fig. 2 and in fig. 12.

The vertebræ that are involved (and when the disease is severe there are several) are fixed to one another by inflammatory adhesion; but yet, during the period of active disease, the carious surfaces can move to a certain extent upon one another, and from and to one another, but the degree to

which separation of the diseased surfaces occurs is, as a rule, slight; so that when a patient raises, or rather draws backwards the upper part of the body for the purpose of looking forwards and of equalising his equilibrium, the vertebræ below the seat of the disease are allowed to accommodate themselves to the alteration in form, and an appearance of incurvation occurs. I say "appearance" because the curve is formed chiefly by an arching back of the vertebræ from the perpendicular line of the body (fig. 8), and not by an arching of the lower vertebræ forwards. In some severe cases, how-

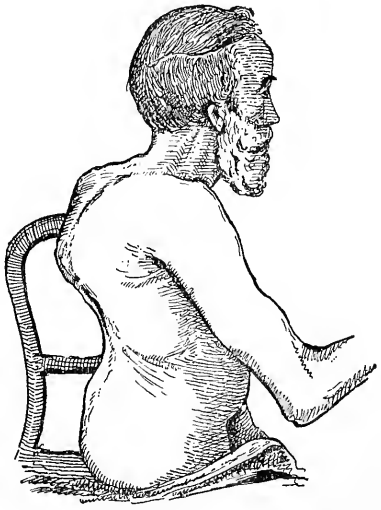


Fig. 12.

ever, there may be a true incurvation as well as an arching back, and the curves may appear as in fig. 10.

In the latter figure there is also an incurvation of the upper part, especially in the neck, in order to allow the face to look forwards; but the bending is chiefly below the seat of the disease.

Lateral Curvature with Caries.

The fact that irregularities of the spine in a lateral direction sometimes accompany caries of the vertebræ has long been known, but these deviations have generally been attributed to a predominance of the disease upon one or other side, leading to bony deformity in a lateral direction.

Besides this kind of lateral deformity in cases of caries, we also often meet with the ordinary appearances of scoliosis. In the first edition of my work, "Curvatures of the Spine," published in 1883, I referred to this subject, and in the second edition, published in 1888, I described more fully the characteristics of this complication of caries. I endeavoured to describe the points of difference between the two affections, and referred to cases in which mistakes had been made in diagnosis, leading to very disastrous results, as follows:—

"The possibility of lateral deformity of the spine being dependent upon caries should lead the surgeon to exercise great care in making a diagnosis in doubtful cases. In caries, the pain is usually of a different kind, easily increased by movements, especially by stooping. In simple lateral curvature, however severe the pain, I have never seen that extreme caution in movements which *generally* accompanies caries. There is, as a rule, more rigidity of the spine in caries as regards flexion and extension, than in slight lateral curvature. The angle of deflexion may be more acute, and there is frequently some posterior projection, as well as lateral curvature. There may be projection of spinous processes in the latter condition, but there is a distinction to be made between the two when the patient stoops. In caries the spinous processes of the affected vertebræ do not as a rule separate from one another, whereas this separation can generally be felt when no ulceration of bones exists. I stated (in a former edition of that work) that no exact rules could be laid down for forming a diagnosis between these two conditions, but that all the symptoms must be studied. I still adhere to this opinion, and in offering the above suggestions for diagnosis, I must urge that none of them are infallible; that caries not infrequently exists, and runs its course without producing the usual symptoms of the disease, and that the knowledge of the many anomalies of these cases should lead us to be very cautious in forming a diagnosis. Sometimes it is necessary to treat the case with caution for a week or two, before coming to a decision.

"In young children great weakness of the back may be present, which, in the positions of sitting or standing, allows the spine to bend in various directions, forming at one time posterior curvature, and at another, one or more lateral curves.

Although this condition would probably lead eventually to the formation of lateral curvature, yet in diagnosis a distinction is to be drawn, for when this state of weakness exists, support to the back, and rest, are more important at first than exercise. In fact, in severe cases of weakness of spine, the strength of the child is more rapidly and safely restored by absolute rest at first than by attempts to exercise the muscles. These curves are readily movable in any direction, the spine being easily straightened or bent.

"I have met with cases in which the symptoms of this kind of weakness of the spine predominated, but which ultimately proved to be instances of commencing caries. An outline of the history of one of them may be instructive.

"A. W., aged $8\frac{3}{4}$, began to stoop about nine months before I saw her. A few weeks before this visit, pain in the abdomen was felt, and recurred frequently. Certainly this pain was suspicious, but there was no other symptom of caries, the child moved about quite freely, and did not complain of other pain or discomfort. There was at that time no irregularity whatever in projection of the spinous processes. I advised moderate exercise, and treated the case upon the principles described below. Nov. 6th, 1885, six weeks after the first visit, the spine was much straighter, and the muscles were developing. The child could sit up better, but the abdominal pain was more troublesome, and as I could not detect any local cause for it, I again examined the spinous processes in stooping, when I found a slight but distinct projection of the eleventh and twelfth dorsal vertebræ, which I did not hesitate to attribute to the existence of caries.

"Other cases have been very similar. The possibility of incipient caries being the cause of the general weakness of the spine, is an additional reason for not advising gymnastic exercises in the early treatment of very weak backs. I have known such a case treated by the Swedish Movement Cure, and the caries developed soon after the treatment was commenced, and increased rapidly and severely before its nature was discovered."

Since the volume above quoted was published I have met with a number of instances in which this same mistake has been made, and when cases of weak back, and slight lateral curvature are treated by exercises, a great risk is run that

some latent disease of the bones, which may be present, will be rapidly developed by the treatment.

More recently the subject has received further attention. In the year 1889, Dr. Bernard Bartow read a paper before the New York State Medical Society, entitled "The Presence of Spinal Distortion in the Early Stage of Spondylitis, and its Value as a Diagnostic Sign." This paper was published in the tenth volume of the "Annals of Surgery," and was illustrated by very interesting photographs. Dr. Bartow is of opinion that some degree of lateral distortion "occurs in almost every case of caries of the spine, appearing even before any angular deformity. When angular projection commences and gradually progresses the lateral deformity becomes less conspicuous, but still contributes in no small degree to the general deformity of the trunk."

"Pathological spinal rotation," he states, "is always associated with the early stage of spondylitis," occurring in the dorso-lumbar region. He considers it differs from scoliosis "in the greater variety of its forms, and in the presence of phenomena of irritation, which may be referred to a vertebral source." It is essentially a deformity of rotation. In the early stage of spondylitis the deformity especially resembles the deformity of scoliosis, particularly when the progress has been slow.

Dr. Bartow's view as to the explanation of this complication of caries is, that in the attempts by the patient to rest the inflamed part of the spine a lateral deviation takes place; the vertebræ rotate as a natural mechanical result; the voluntary reflex contraction of the muscles immobilises the bones in such position; and subsequent destructive changes confirm the malposition.

In the *Revue d'Orthopèdie* for November, 1892, Dr. le Kirmisson writes upon the same subject. He gives many instances of lateral curvature in Potts' disease simulating Scoliosis, but he does not agree with Dr. Bartow that it occurs in every case. Dr. Kirmisson refers especially to the American surgeons as elucidating this important point. He quotes Dr. Henry Taylor and Dr. Ketch, of New York, and also Dr. Lovett, of Boston. He records twenty-four instances which he has met with of lateral deviation in Potts' disease out of 123 cases.

Dr. Lovett has noticed in such instances, less of the rotation

of the bones, and more of a bending *en masse* of the trunk to one side.

It is a most serious matter that the importance of this combination of lateral curvature with caries should be recognised, and I think there can be no doubt that it has not received as much attention in this country as it deserves. This is especially the case so long as the fashion prevails for treating all cases of weak spine and commencing lateral curvatures by means of long-continued exercises.

As already stated, I have met with not a few instances in which this "exercise" treatment has rapidly developed an obscure case of caries, the lateral deviation which has been present having unfortunately been considered conclusive evidence that no inflammatory disease has been present.

That lateral deviation may occur in caries from structural changes has long been recognised, but that lateral curvature of the ordinary scoliotic form should accompany, and even precede the majority, or at least a great number of the

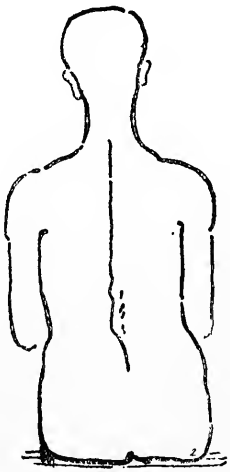


FIG. 13.

Male, aged 20½ (April 2, 1889). The spine had suffered from a fall, occurring six months previously. It seemed possible there might have been partial fracture at the time of the accident, causing the malposition of the spine in this case.

ordinary symptoms of caries, has not been generally acknowledged. The latter is a curvature with rotation which accompanies the caries, and which extends beyond the area of inflammation, and it is chiefly the result of weakness and discomfort.

In my own practice I have observed lateral deviation to accompany caries in the following varieties :—

1. From general weakness.
2. From spasmodic muscular action.
3. Occurring independently, as for instance in cases where one leg is short.
4. From lateral loss of substance by the caries predominating upon one side.
5. From some other unusual causes.

I have made drawings of some of the patients in whom I have found caries to be thus complicated, and as the subject is an important one I give several instances of this peculiarity.

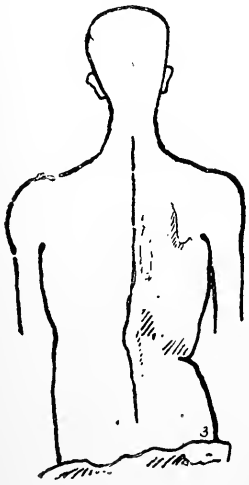


Fig. 14.

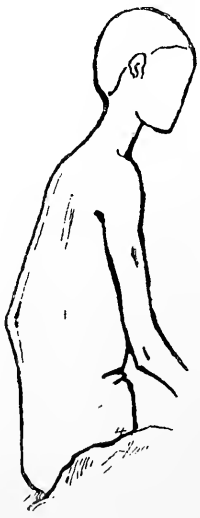


Fig. 15.

Figs. 14 and 15 represent the back and side view of a male, aged 30 (July 10, 1889), who was in a very critical condition at this time. It will be seen that there are several lateral irregularities. These were probably caused by tubercular disease, attacking the spine laterally, in several parts as well as chiefly in the region of the twelfth dorsal vertebra, as shown in the profile view.

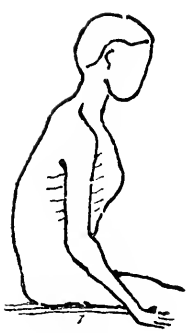


FIG. 16.

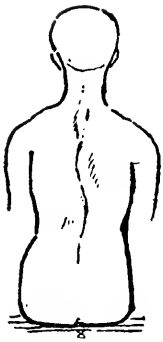


FIG. 17.

Figs. 16 and 17 represent a boy, aged 5 (April 20, 1886). He was an extremely feeble child, and was suffering from caries involving the vertebræ from the sixth cervical to the fourth dorsal, and probably also the vertebræ in the dorso-lumbar region. Under treatment he made very good progress at first, but had not the strength to maintain it. He died about a year subsequently from tubercular meningitis. The lateral curvature in this case was undoubtedly caused by the general weakness.

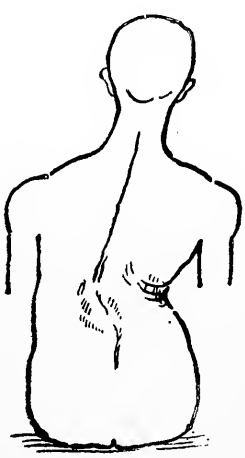


FIG. 18.

FIG. 19.

Figs. 18 and 19 represent a lady, aged 24 (July 10, 1890). There was caries in this case, but it was complicated by there having been a spina bifida, which gradually collapsed, until at the age of 13 it had disappeared. At the time of her visit she was getting rapidly worse, but by means of support and fixation she was almost entirely relieved from pain, and was placed in a much more upright position, as shown in fig. 19. Some lateral deviation, however, remained, and there was great bony thickening round the involved vertebræ.

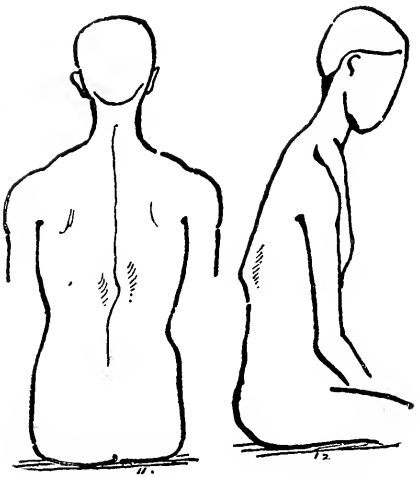


FIG. 20. FIG. 21.

Figs. 20 and 21 represent the case of Miss H——, aged 15 (May 3, 1892), whose back began to suffer after a severe attack of typhoid fever three years previously. The general health was feeble, and the patient felt very tired after any exertion.

August 24, 1892. An abscess was found to be projecting in the left inguinal region.

In April, 1893, the abscess was less prominent, and since the fixation of the spine there has been no increase in the projecting vertebræ, and the patient is now very well in general health. The lateral curve was probably caused by the predominance of the disease on one side.

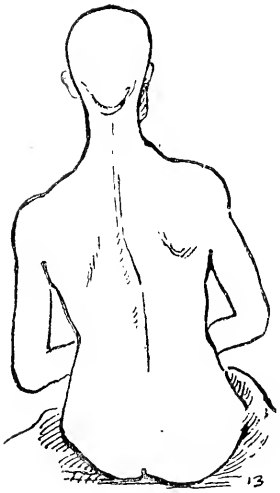


FIG. 22.

Fig. 22 represents Miss B——, aged 17 (June 25, 1892). The back was first noticed to be bad eight years earlier, and it had been lately getting worse rapidly. The pain was constant. There was a family history of tubercle, and she had been treated by recumbency, which had given relief, but had not stopped the progress of the disease.

She was soon benefited by fixation of the spine. The lateral curve, as in the former case, was probaby due to the disease predominating on one side.

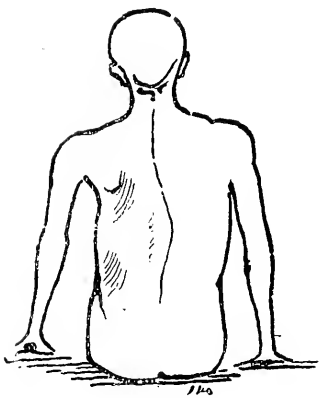


FIG. 23.

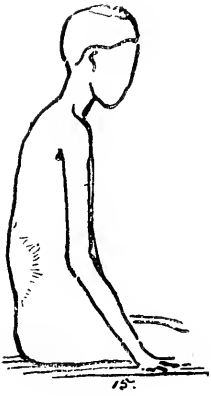


FIG. 24.

Figs. 23 and 24 represent Miss W——, aged 7 (October 24, 1892). A year previously she first complained of pain in the right inguinal region. She had lost the power of walking and suffered great pain from the least movement. Caries in this case probably involved not only the dorso-lumbar region which projected, but probably also some vertebræ above. The lateral deviation was due to the general weakness, as the patient was quite unable to sit up without supporting herself with her hands.

April, 1893. She had been quite free from pain dating from soon after the spine had been thoroughly supported, she was very much better in general health, and the spine was straighter.

Alto-axial Disease. — Caries occurring in the first two vertebræ is apt to differ somewhat from the disease when situated lower in the column. It has been stated that in this situation the disease is rarer than formerly, and such fact, if it be one, has been attributed to the caries, in this situation, having been caused in former days, by syphilis which had been allowed to "run on unchecked for longer periods, or was treated too freely with mercury."[1] It is quite conceivable that syphilis of the throat might extend to the cervical vertebræ, but I doubt if it has been proved that there is much difference in its frequency in this situation.

The free mobility of these bones renders them less liable to the sort of injury which is often the exciting cause of caries, but I have seen many cases of disease, in this situation, in some of which the symptoms have been rather obscure.

Alto-axial disease is more prevalent among adults, although sometimes met with in quite young children. Destructive changes may be very rapid in this part, and repair also may take place more quickly than in other parts of the spine, yet it is well not to depend upon this more rapid healing too confidently.

The peculiar symptoms of disease in this situation may be— pains referred to the throat in swallowing, torticollis (see page 40), projection of an abscess or of the body of a vertebra in the pharynx, and pain in the occipital region. Great anxiety of countenance may be present, but is not always so; posterior projection of the spinous process of the axis, and œdema of this part are also frequent symptoms. When the patient turns his head to one or other side, the whole body is turned also. Should the disease get worse, and the head continue to glide forwards, the odontoid process of the axis may eventually press on the medulla oblongata, and so produce fatal paralysis. Death may even occur quite suddenly from a giving way of the transverse ligament.

The Progress of Spinal Caries.

The inflammation usually commences in the anterior part of the spinal column, generally in the bodies of the vertebræ

[1] Holmes' "System of Surgery," 3rd edition, vol. ii., p. 420.

themselves, or at the junction between a vertebra and an intervertebral cartilage. The disease extends backwards, also upwards and downwards, and it eventually attacks, in extremely severe cases, the articular processes, and also the articulations between the ribs and the spine.

Caries sometimes commences in other parts of the bodies of the vertebræ. Under such circumstances the symptoms may be insidious and the progress of the disease slow ; fig 25 represents such a case. It is described in the St. Mary's Hospital Museum catalogue (A. B., 142) as caries of dorsal vertebræ in a male aged 21. He had been an athlete, ill only

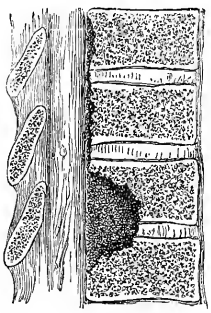


FIG. 25.

one month before admission for *pleurisy*. No symptoms of the caries were complained of, and the diseased state of the bones was only discovered at the *post-mortem* examination. He died from croupous pneumonia.

A specimen in University Hospital Museum illustrates another form of the disease in which the ordinary deformity does not occur (see fig. 26). It will be obvious that in such cases the diseased parts are not subject to so much compression or disturbance from the movements of the body as in the commoner forms of the disease, and therefore the symptoms are less obvious.

In ordinary cases projection appears sooner and increases most rapidly when the disease is situated in the dorsal region. This result is the consequence of the natural curve of that region backwards, the pressure upon the diseased part being

then greater. In the lumbar and cervical regions the natural anterior curve has to be obliterated before a posterior projection is formed. Therefore the amount of deformity is not a sure indication of the extent of the disease, unless its situation be taken into account. These remarks apply more to cases in which the deformity is a curve, than to those in which it is an angle.

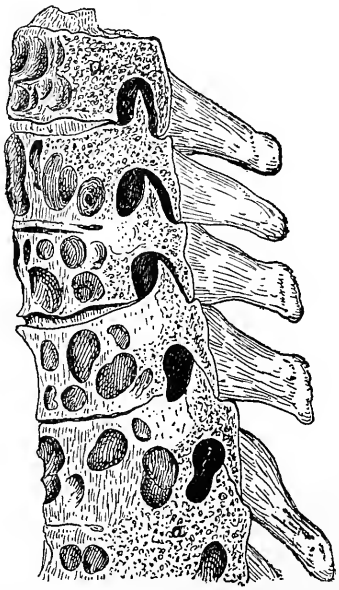


Fig. 26.

Fig. 26 "Illustrates the effects of *osteo-myelitis granulosa* of the strumous form acting upon the front of the bodies of the vertebræ, and leaving the inter-vertebral discs intact. The latter are dried and shrunken in the specimen, but normal. The 'pitting' by pressure of bosses of granulation tissue is well seen hollowing out the bodies, and starting underneath the anterior common ligament. The surface behind (*a a*) is made by a saw-cut removing the transverse processes." (From Holmes' "System of Surgery," vol. ii., p. 404, A. E. Barker.)

If the disease is situated in the lower lumbar or upper sacral region, *incurvation* of the vertebræ above the disease may occur and be the most marked abnormal appearance. This is especially the case in those peculiar cases called Spondylolysthesis. When the disease is situated in the upper

dorsal or lower cervical region, the head subsides vertically, and approximates to the upper part of the chest, the appearance of the neck being more or less obliterated. Accordingly the occiput may come in the way of an examination, preventing the tips of the spinous processes from being felt by the fingers, or the head may assume other positions.

In any case of weakness of the back causing posterior curvature, even if it only amounts to a slight stoop, the chest usually becomes flattened and the thoracic cavity reduced in size.

Caries in any part of the spine may, by causing weakness and consequent stooping, affect the chest in this manner,

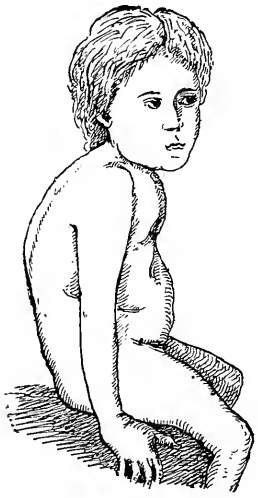


FIG. 27.

Alteration in the form of the thorax.

and disease in which the dorsal vertebræ are alone, or chiefly involved (figs. 27 and 11), as already stated, has the more marked effect upon this part of the trunk.

Disease involving loss of substance of the front part of one or two vertebræ in the dorsal region causes flattening of the chest, but sometimes the front of the thorax comes to project again while the angular projection of the spine increases; the

height of the patient then decreases, the ribs collapse upon one another, and the chest becomes flattened laterally. The sternum is then pushed forwards and a sort of "chicken breast" is produced. It is, I think, only in the more favourable cases that this development of the chest takes place, and especially when treatment has helped in this development. The following instance (figs. 28 and 29) especially shows the effect of

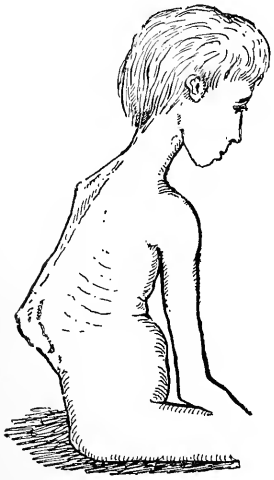


Fig. 28.

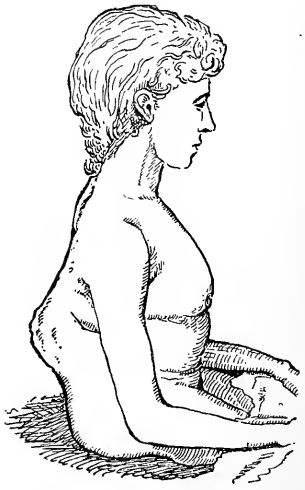


Fig. 29.

treatment in this respect. The child was in a very critical condition when I first saw her (described, p. 125), but is now practically well. Fig. 28 is from a sketch I made of her in April, 1884, and it will be noticed that the chest is much incurved. Fig. 29 is from a photograph taken in October, 1891.

From compression of the chest by its collapse, and the consequent lessened capacity of the thoracic cavity, the vital organs therein contained are displaced, and more or less interfered with in their functions. Impeded respiration and circulation are marked symptoms of this condition, and depend partly upon absolute compression, and also upon interference with the nerve supply of the heart and lungs.

When the upper cervical vertebræ are attacked, the head is bent and protruded more or less forwards and downwards in a "contemplative" attitude, which is very characteristic.

When the lower cervical and upper dorsal vertebræ are affected, the deformity of the back generally assumes a rounded lump-like projection, and the head droops downwards (fig. 31), the patient often having a sad and painful expression of countenance.

In other cases the head is held so that the face presents more upwards, giving the patient a rather consequential look. The exact position depends much upon the feelings of the patient. In the active stages, if there is much pain, the inclination is generally to droop the head, whereas during

FIG. 30.

recovery or after ankylosis has taken place (should such a result occur) then the head is held up with the object of seeing straight forwards. This effort necessitates the position which I have above referred to as giving a consequential look. When the disease is in the lumbar region, the patient may bend his body forwards, but sometimes he will hold himself remarkably upright.

Movements.—In whatever part of the spine the caries exists, the patient will, while the disease is in an acute form

in typical cases, move with extreme caution, support himself in standing by placing his hands upon his knees (fig. 7), inclining his body forwards, and bending his knees to give the necessary prop to the body. In sitting upon a chair he will prop himself up by resting the weight of his body upon his arms, his hands resting on the seat of the chair (fig. 3). In sitting at a table he will rest his elbows upon the table, and support his head upon his hands. He moves with caution, and avoids jolts and jars. If he wishes to pick up something from the floor he does not bend his back, but stoops by

FIG. 31.

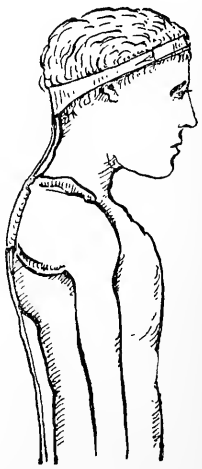


FIG. 32.

Fig. 31.—A. B., aged 9 (July, 1892). No previous treatment, having had no pain whatever. He had been running about freely, but of late months had been getting rapidly more deformed.

Fig. 32.—A. B. (April, 1893). Position of head had been gradually improved by use of supporting apparatus.

bending his hips and knees, keeping the spine quite rigid. Whatever he does, this care and deliberate action is observed.

I have stated that these characteristic movements occur in typical cases, and I would emphatically urge that there are a great many instances which are not typical, *in which pain is entirely absent or very slight*, and in which therefore the

postures which are assumed to avoid the production or increase of pain are also not present, or in only slight degrees.

The Etiology of Spinal Caries.

The exact nature of the disease was, until comparatively recently, a subject of controversy. It is so closely associated with *tuberculosis* that the majority of writers have considered it essentially or entirely a tuberculous affection, and recent researches go to show that this view is probably correct in the large majority of cases, but even in recent years there have been surgeons who have thought that the disease might be brought about by injury alone. The latter have admitted that tuberculous individuals are much more liable to the affection than those who are healthy, but they have urged that accidental injury is generally the exciting cause, and may, in delicate individuals, be alone responsible for the caries.

If we consider that modern researches have proved that caries of the spinal column is essentially a tuberculous disease, we have yet to draw a great practical distinction between those patients who are so far affected by tuberculosis that they show its influence in other and various ways, and those in whom the disease of the vertebræ is the only obvious affection.

The explanation of these differences of character in various cases is, probably, that tuberculosis is a local affection in the one class and a general disease in the other. The localised nature of tuberculosis in its early stages is now very generally accepted as a fact, and great stress should be laid upon the importance of recognising this local nature and of combating it before it has become general. Tuberculosis may be overcome so long as it remains local, and possibly, also even when it has to some extent invaded the general system, but obviously the latter condition is much more difficult to deal with than the former. In the latter our greatest efforts will be needed to contend with the general effects of the disease, whereas in the former, although we must by no means neglect the general, we may expect to effect a cure chiefly by local treatment.

In a patient affected by general tuberculosis, the disease is not only a strong predisposing cause of Caries, allowing quite

a slight injury to set up this affection, but in some instances it leads to the development of tubercular softenings in the

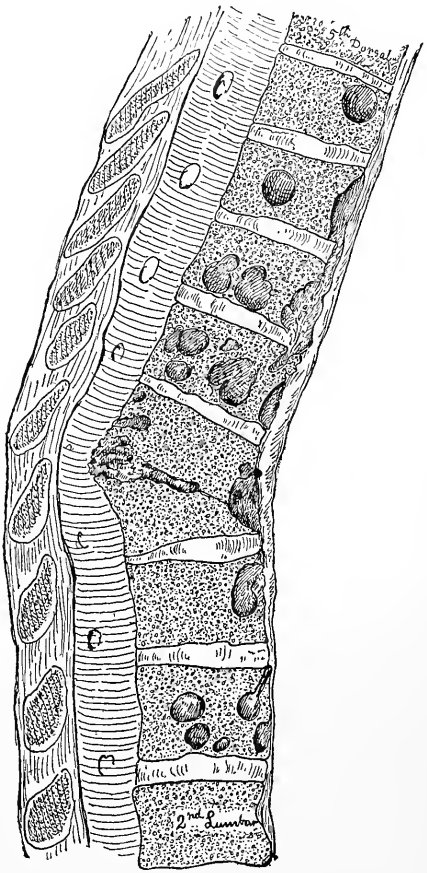


Fig. 33.

Drawn from a specimen in St. Bartholomew's Hospital, No. 1064. It consists of a vertical section of a portion of the spine, including the fifth dorsal to the second lumbar vertebra. Between the tenth and eleventh dorsal vertebræ there is destruction of bone leading to angular deformity, but in other parts of all the vertebræ shown, hollow spaces, more or less cup-shaped, exist.

vertebræ, which from their character and situation could not have been in any way induced by local injury. This is so

when the surfaces of the vertebræ or central parts are hollowed out in numerous places, as in fig. 33, and also in the case already described, fig. 26.

When the disease is concentrated to one part, producing a sharp angle in the back from projection of the spinous processes, there is more probability that the active cause has been an injury, whatever the constitutional condition may be. In support of this opinion it should be noticed that the ulceration in Caries first attacks precisely that part of the column which is chiefly injured in cases of fracture, and there is no other apparent reason why one particular spot should be attacked than that it results from injury (see figs. 34, 35, p. 42).

In support of the view that the disease in many cases of caries of the spine is not the effect of general tuberculosis (although it may be that disease in a local form) is the fact that disease of the spine often occurs in children and older patients who are otherwise robust and apparently healthy, and in whose family history no record of tubercle exists, and whose life prior to some fall has been especially free from ill health or signs of constitutional weakness.

An apparently healthy child has a fall, more or less severe, and complains of pain in the back. This pain may continue, or it may cease in a few days and recur in about one or two or three months' time, after which the pain comes on severely, and many other symptoms of caries establish themselves, while shortly afterwards a slight projection in the back is noticed.

Should such a case continue inefficiently treated the disease advances, and in the course of some months abscesses form, and the general health at last breaks down, and then the tuberculous nature of the affection asserts itself, and general tuberculosis is likely to supervene.

The condition of general health of patients differs widely, and we meet with every variety, from the markedly feeble and unhealthy to the markedly robust. Some patients are from the first appearance of the affection undoubtedly tuberculous, whilst others show no other sign of tuberculosis than the affection of the spine. It does not need any argument to show that the latter are the more favourable patients to treat, while at the same time it must be stated that in some of the most unpromising instances careful treatment has been fol-

lowed by a perfect, or apparently perfect, restoration to health, always excepting that after a decided degree of deformity of the spinal column has taken place, a return to the previous condition of symmetry is impossible.

Syphilis.—Children suffering from inherited syphilis may be affected with spinal caries, and treatment will probably fail until we make use of mercury or iodides. These cases often present other manifestations of syphilis, such as skin eruptions, opacities of the cornea, syphilitic teeth, &c. A distinction should be drawn between these cases and syphilitic (contracted) disease of the vertebræ in older patients (see p. 57).

CHAPTER II.

SYMPTOMS AND DIAGNOSIS.

We may divide the symptoms into three stages :—(1) Those occurring before deformity has appeared; (2) those occurring when deformity exists, and (3) those occurring when abscess, paralysis, and subsequent general giving way of the health are manifest.

I do not propose to follow this arrangement in describing all the symptoms, as such a course would not be convenient, but the order should be kept in mind. The first stage is the least accurately defined. There is always difficulty in diagnosing the disease at this early period, whereas much less exists in the majority of cases at the other two.

The first symptoms are generally languor, listlessness, and unwillingness to move much or quickly, all the actions indicating, more or less, stiffness in the spinal column, but in cases where movement does not cause pain, stiffness may not be present. A stumbling or shuffling gait may soon appear, or the legs may cross one another, especially when the patient is sitting in a chair, and in walking the difficulty occurs chiefly in attempts to hurry; also there may be stiffness, or spasmodic movement, of the thighs.

In addition to the stiffness of the spine just mentioned, the patient may keep his whole back rigid and supported by resting his hands upon something before him, or upon his knees, or, while sitting, placing his hands upon the sides of the seat, or in cervical disease, his elbows on the table and supporting his head on his hands. In stooping to pick up an object from the floor he will keep the spine rigid and bend his knees and hips. By these actions he transfers the weight from the anterior diseased parts of the spine to the posterior healthy parts, and lessens the nerve irritation which has caused the discomfort. If the disease be situated in the lower cervical, or in the upper dorsal region, upon slight efforts at exercise

the respiration will be unnaturally hurried, and a grunting noise will be made, and there may be a hard dry cough.

Pain may commence early, either as a dull aching in the back or in the front of the body. Pain will occur upon sudden movements, especially in stooping or twisting, or in stumbling. If this is the first symptom it may date from the time of a fall or other traumatic injury.

Pain is often referred to a hip, knee, or ankle, and the affection has been mistaken for disease of one or other of these joints. The supine horizontal posture usually affords some relief to the patient, but the prone position is generally much more effective in relieving this symptom.

As the disease progresses, cramps and convulsive movements occur in the legs. A chilly feeling or a feeling of tension in the thighs may be experienced, the appetite fails, the pulse becomes rapid and feeble and sometimes irregular. Gradually or suddenly the power over the legs is lost. Complete paralysis may eventually take place below the diseased vertebræ, involving the rectum and bladder, and causing atrophy of the muscles of both legs, and the legs are generally cold. Or the paralysis may extend higher in the body, even involving the arms. Projection of the spinous processes of the affected vertebræ will probably have occurred long before the advent of inability to stand, the projection often being the first symptom noticed.

When complete paralysis exists, the patient is liable to the formation of bed-sores, but not to the same extent as in paralysis from degeneration of the spinal cord. Disease may, however, be very extensive in any region without causing paralysis.

The peculiarities of the bony deformity have already been described.

In acute cases there is frequently œdema of the tissues on each side of the spine, in the region of the disease.

The symptoms naturally vary in accordance with the seat of the disease. If the caries exists in the cervical vertebræ, we may have pain in the throat, difficult deglutition, or difficult respiration and embarrassment of the action of the heart. If in the lower cervical and upper dorsal regions, the movements of the arms may be affected, and as the seat of disease descends, indigestion, pain or feeling of tightness in the stomach

may be experienced. If in the lumbar region the pelvic viscera may show symptoms of nerve irritation.

The discomfort at the epigastrium is sometimes described by the patient as resembling the sensation of a cord tied tightly round the body, or as a band pressing firmly, but in very young children the symptoms of pain are less definite—a child may complain of stomach ache. Pain situated in the parietes is usually symmetrical, but not unfrequently it is on one side only.

Pain is a very uncertain symptom, for it may vary much in degree. Exacerbation of pain commonly occurs suddenly in the night, and this may cause the patient, if a child, to utter a sharp cry. Pain may be entirely absent, or exist to such a slight degree that it is very easily attributed to other causes. The latter facts have certainly not received sufficient attention, for the opinion is very prevalent that the absence of pain is positive evidence of absence of inflammatory disease of the spinal column.

Pain is chiefly felt in the peripheries of the nerves proceeding from the spinal column. Thus uncomfortable sensations in the chest, abdomen, or pelvis, or legs, may be alone complained of, or the pains in these parts may be severe, while only a dull aching is felt in the back itself.

It will often be found that the pain proceeds in the line of the spinal nerves, commencing near the spine and proceeding downwards and forwards to the front of the body, commencing to be more severe at the side or sides. A dull, aching pain in the immediate neighbourhood of the diseased vertebræ is frequently felt in acute cases, and this will often be increased by the patient bending the body forwards.

If there is pain on firm pressure of the spinous processes or in their immediate neighbourhood, it may be acute, and is often complained of as a burning sensation. There is a peculiarity as regards pain from caries which sometimes is met with, especially with adults. Extra exertion will not produce immediate pain, and a patient may even feel better for a brisk walk, but a few hours afterwards the pain will occur and remain for several hours, and probably until prolonged rest is obtained, such as rest in bed. Pain is usually relieved by rest, and is often absent in the morning after a good night's sleep, but commences soon after getting up and increases during the day.

The pain is especially increased by a stumble, or by twisting, and by all sudden jarring movements, and in the second stage may be described by the patient as a feeling "as if his back would break." Firm but careful pressure with the hands of the surgeon upon the patient's shoulders, from above downwards, may produce pain, but this test should be applied with great caution, if at all.

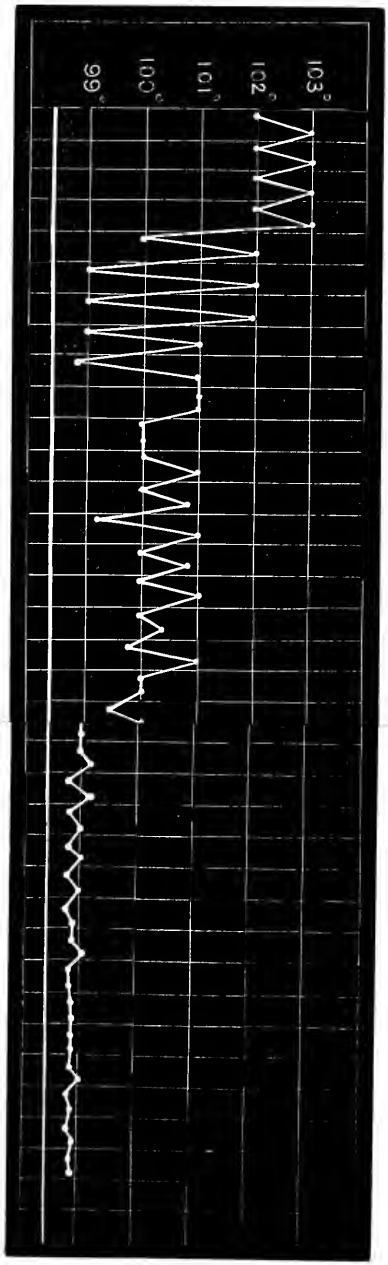
Hyperæsthesia may be detected locally by passing a hot sponge along the back, and electrical stimulus will produce pain below the angle of deformity, passing downwards and outwards in the lines of the spinal nerves.

High Temperature.—This is a very important symptom, and is of especial value in cases where the diagnosis is, as far as other signs are concerned, doubtful. In acute tubercular caries there is very often, but not always, a rise in temperature. The following case well illustrates this subject :—

Miss E. H., a very delicate-looking girl, aged 16, began to suffer severe pain in the lumbar region in April, 1893, and had gradually got worse.

When I first saw her, August 9, she had recently recovered from influenza, but the temperature had risen again to 102° in the morning, and 103° in the evening. It had been so for the previous fourteen days. There was at first a question as to some specific fever. I found projection of the twelfth dorsal and the first lumbar vertebræ, and great pain in that region and below it. The spine was very rigid. The case was obviously one of caries, and I thought that the high temperature was the effect of tubercular disease. Dr. Seton, who had charge of the case, coincided with my opinion. I anticipated a lowering of the temperature as soon as the spine was thoroughly fixed.

The accompanying chart is worth studying, as it shows gradual lowering of the temperature in exact accordance with the gradual perfecting of adjustment of the instrument. It will be noted that the day following the application of the splint the temperature dropped from 102° and 103°, which it had been for eighteen days, to 2° lower in the morning, and to 1° lower in the evening, gradually decreasing during the succeeding days. After each fresh adjustment there was a small temporary improvement in the temperature, but after the drop of the first four days it remained practically the same for nearly

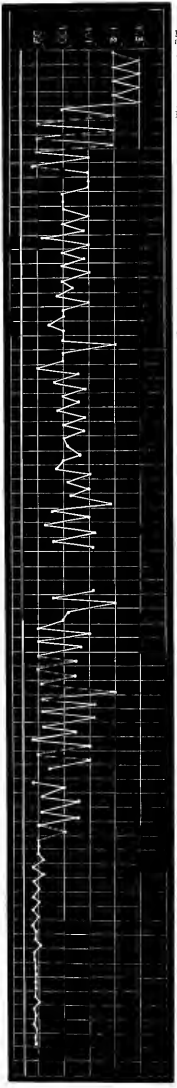


August, 1893. — Miss H——, pain in lumbar region four months, and gradually increasing.

This temperature for 14 previous days.

Instrument applied.

Readjustment.



August, 1893. — Miss H——, pain in lumbar region four months, and gradually increasing.

This temperature for 14 previous days.

Instrument applied.

Readjustment.

September.

Readjustment.

General readjustments. Patient gradually improving both in health and in posture of back.

October. Readjustment. Getting apparatus into a very good position. Spine being equally supported in all positions.

six weeks, when a further improvement took place, after which the temperature remained very steady, a fraction above the normal, and a week later it became perfectly normal and has remained so.

At the date when this practically normal temperature was attained I had just succeeded in so arranging the apparatus that it proved a perfect support in all postures of the body. The spine had been gradually subsiding to a position in which it now remained fixed. The patient had been also improving in every other way—in healthy appearance, in gradual lessening of pain, and having a better appetite. The patient's listlessness and disinclination to do anything for herself, and some other symptoms, had led the relations to consider that some at least of her symptoms were hysterical. This view I could not agree with, and the hysterical symptoms all disappeared with the disappearance of the high temperature, and with the other improvements.

This seems a very characteristic case of active tuberculosis of the spine, but from treatment by local fixation, and with general medicinal and dietetic remedies, the patient continues to improve, and there seems every probability of a cure being effected.

The temperature should be regularly taken in all cases of caries. I have found it a valuable diagnostic symptom; a slight rise perhaps of about one degree of temperature only, often being present in caries when the diagnosis has been otherwise doubtful. Certainly one meets with many cases of caries in which no rise of temperature can be detected, but upon more extended observation in this matter I have no doubt very valuable statistics may eventually be obtained.

Rigidity.—There is usually more or less rigidity of the spine in the neighbourhood of the disease, and this is an important symptom in the early stages of caries. It is the result chiefly of muscular spasm from reflex action, or voluntary muscular action to prevent pain, but may also occur from the exudation of the products of inflammation.

Rigidity in caries of the spine is not, however, so clearly defined as it is in cases of inflammation of the more movable joints, as the hip and knee, and in many cases it cannot be very clearly detected.

If the disease be situated in the lower dorsal or in the

lumbar vertebræ, causing slight posterior projection in these regions, it may be a question whether the projection is the result of posterior curvature from weakness of the ligaments of the spine or from caries. Under such circumstances the presence or absence of rigidity should be determined. The patient should be placed in the prone position, when, if the case is one of weakness only, the projection disappears, whereas if inflammation exists the projection remains more or less. Careful elevation of the legs, while the patient lies in the prone position, will intensify this result. Movement in other directions will also generally be found limited as a consequence of the rigidity when caries is present.

In cervical disease the rigidity shows itself in stiffness of the neck muscles, and this often affects the head laterally, producing wry-neck. There is usually a great difference between wry-neck from caries and that from permanent muscular contraction. In the latter it will probably have existed for a long time, and there will be little or no pain, or at least of a less distressing nature; there will be firm and unalterable contraction of the sterno-mastoid alone, and the face may be atrophied on the depressed side and the features distorted.

In caries, other muscles as well as the sterno-mastoid will probably be affected, and the head will be held in a manner more expressive of pain, and support of the head will relieve the contraction and the pain to some extent.

In simple Torticollis the movements of the head are only restricted in one direction; in Caries the head is kept in one position, but not commonly restricted in any if carefully handled, because, in torticollis from caries, movements in any direction are painful, whereas in true torticollis pain, if any, only occurs from movement in one direction. Rest in bed for a few days will often relieve the torticollis of caries.

In the latter affection there may be a condition of spasm in the contracted muscles, and in adults it may be difficult to distinguish between this disease and "Spasmodic torticollis."

I have known torticollis having all the characters of the simple affection to exist in a child for many months before it was recognised as a symptom of disease of the bones. Inflammation of lymphatic glands of the neck alone may produce torticollis, and this may be very difficult to distinguish in its

early stages. In caries of the cervical vertebræ there may, however, be very free movement.

In caries occurring in the dorsal or lumbar regions, rigidity may be observed in the psoas muscles (or in one psoas only), being perhaps associated with psoas abscess, and this may produce lordosis instead of posterior projection. Such cases must be distinguished from simple local inflammation of psoas muscles, which is not always very easy; however, the latter condition is rare.

These cases also may be mistaken for hip disease.

In both instances other characteristic symptoms of the individual affection must be depended upon. In hip disease it may be remarked that the stiffness of the joint exists in every direction, as well as in extension, yet in some cases of lumbar disease the hip is found very stiff, and the diagnosis may be extremely difficult. Then again, the lumbar region may be very stiff in hip disease.

There may be a certain amount of rigidity in lateral curvature, especially in rachitic cases. In rachitic kyphosis, rigidity may be very considerable and quite like that in caries.

Nerve Symptoms.—The difficulties in walking above referred to as occurring at a comparatively early stage of this disease, the subsequent loss of power over the muscles, the pain, and some other symptoms, denote lesions more or less severe of the nerves.

The motor nerves are chiefly affected, commencing with weakness in the legs and increasing until complete paralysis of motor power takes place.

The range of these nerve symptoms depends upon the position of the disease, almost always being limited to the nerves proceeding from the diseased bones and below that position.

In paralysis from cervical disease the arms may be affected, and all power of motion below may be lost. Herpes zoster may occur.

Spasmodic movements of the limbs may become a troublesome symptom, the legs jerking suddenly without giving the patient any warning. The thighs may be jerked into a severely flexed position, or spastic paralysis may take place. Exaggeration of the reflexes is an early symptom of commencing paraplegia, the knee jerk being especially increased, and ankle clonus may

be found to exist. Although both legs are usually attacked simultaneously, one leg may be affected before the other, or in a greater degree, or even one leg alone may suffer. Paralysis of the diaphragm may occur. When pain in the course of the nerves precedes paralysis, this shows that irritation of the nerve roots occurred prior to implication of the cord, and precludes any supposed disease originating in the cord itself. (Gowers).

There is not, as a rule, any pressure upon the spinal cord from narrowing of the spinal canal in this disease, for even in severe deformity the front wall of the canal being lost, the lumen of the canal is not diminished when the upper part of

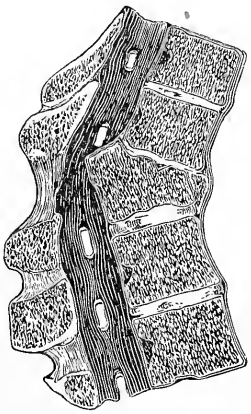


FIG. 34.—Fracture.

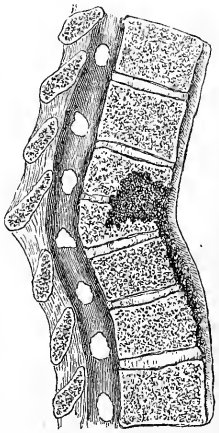


FIG. 35.—Caries.

From specimens in St. Mary's Hospital Museum.

the column falls forwards. In this there is a distinct difference from cases of simple fracture, when the vertebra below the injury presses upon the cord by the gliding forward of the column above (see figs. 34 and 35).

That severe injury to the cord is rare as the result of loss of substance of the bodies, even when several of the latter have been dissolved away, is attributed to the effusion of plastic material in the locality, and to the quietness naturally observed

by the patient when so severe a condition exists. The change, moreover is gradual, and therefore the structures have an opportunity of accommodating themselves to the deformity.

I would now especially refer the reader to Case No. 1 (figs. 70, 71), where a considerable gap existed, and where, as a consequence, very little force would have been necessary to fracture the attenuated bones which remained, but where the utter prostration of the patient, and the great pain caused by the slightest movement, proved to be a safeguard against mischief of this kind taking place. Had there been a sudden movement and fracture had occurred, irreparable mischief would have ensued to the cord.

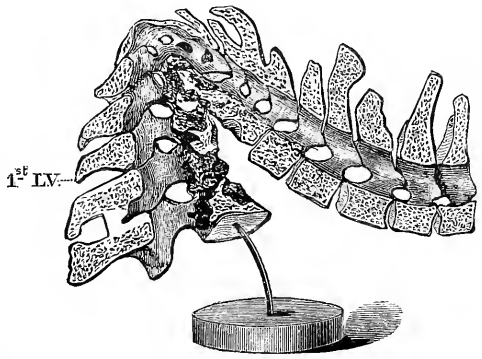


Fig. 36.

Very severe case in which no mechanical means had been used to prevent deformity, but in which consolidation had eventually occurred with very great distortion of the body.

Pressure upon the cord may however take place when no effectual means are taken to fix and support the spine. The inflammatory products, or the *débris* of bone may be pressed backwards, as the upper part of the column falls forwards, pressing on the cord, and similarly pressure may be produced upon the nerve trunks, or a blood vessel may be ruptured by an incautious movement, and pressure ensue. But the nerve symptoms in caries are much more frequently the result of the inflammatory process extending to the cord or nerves.

It is these inflammatory affections of the cord and nerves

which are the cause of most of the acute symptoms of the disease as already described, and they differ according to the locality of the affection.

It is the extension of this inflammation which ultimately may cause paralysis of the legs, or even of the trunk, and in some cases of the arms also. Dr. Buzzard[1] has described the condition of the cord in caries. There is chiefly a degeneration of the axis-cylinders in the nerve fibres, and an increase of the connective tissue between the fibres, and these changes extend to a gradually decreasing extent both upwards and downwards from the place of diseased bone.

Symptoms of compression of the cord may also be caused by tumours or from the bones in rickets. In the case of a tumour, especially an osseous tumour, the symptoms are very gradual, but when pain begins it is extremely severe, and aggravated intensely upon the least movement, more so than in most cases of caries.

Such symptoms will not be so entirely relieved by fixation as in caries. However, it must not be forgotten that it is possible to have pressure from a displaced vertebra or piece of vertebra even in caries. Pyæmic abscess in the bones has been known to produce symptoms similar to caries. In caries symptoms of compression *may* occur suddenly from displacement of some of the products of inflammation, consequent upon a sudden movement. Paralysis involving the sensory nerves is much less common than motor paralysis.

Dr. Gowers suggests that when the sensory nerves are affected this indicates that the damage to the cord is severe, because both in the cord and in the nerves a greater degree of damage is required to arrest sensory than motor conduction, one explanation of this being probably that a slighter nerve impulse suffices to excite the sensory centres in the brain, than is necessary to stimulate the motor structures in the muscles.

We see in severe cases of caries not only paralysis but a perfect spastic condition of the muscles, and experience shows that even in such circumstances recovery is not impossible. This condition probably indicates degeneration of the lateral

---

[1] "Diseases of the Nervous System," 1882, p. 120.

columns (pyramidal fibres), but as regeneration may occur in the case of peripheral nerves, so there is no reason why it should not take place in the lateral columns of the cord.

Abscess.—It is probable that in a very large majority of all cases of spinal caries, an abscess forms at the seat of the disease. Caries may exist without the formation of an abscess (caries sicca), but for practical purposes we may assume that an abscess, large or small, occurs in caries whenever there is marked projection of the vertebræ backwards, and also even in cases where no deformity exists.

The abscess[1] is situated at the seat of the diseased bone, more or less at the front part of the spine, and it may increase gradually, but generally slowly, until it presents somewhere outwardly. Or it may remain in the neighbourhood of the disease, and never appear externally. In either case it may eventually dry up and become partly or entirely absorbed.

If the disease is arrested before the abscess is detected outwardly, then the chances are greatly in favour of the further progress of the abscess also being arrested, but this does not necessarily happen. Although the disease of the bones is stayed, and the abscess shut off from its source, yet the latter may continue to enlarge, and may gradually burrow outwardly.

An abscess which presents outwardly, takes a course dependent chiefly upon the seat of disease, and is influenced by gravitation.

The majority of cases of vertebral caries being situated in the dorso-lumbar region, the pus usually follows the course of the psoas muscles and presents in the groin, and is called a psoas abscess. A psoas abscess usually projects below and between the outer and middle thirds of Poupart's ligament. The abscess may not open in the groin, but descend down the thigh inwards and forwards, being limited externally by the sartorious muscle; or it may turn inwards over the adductor longus, or it may descend the leg to the knee or ankle. A psoas abscess has been known to make its way into the spermatic canal, and appear at the external abdominal ring like an inguinal hernia, and it may enter the scrotum, or it may open

[1] It has been shown that spinal abscess does not, as a rule, contain true pus, but disintegrated cells suspended in fluid. Inoculation of guinea pigs with this fluid has produced tuberculosis.

in the perinæum, or it may pass over the crest of the ilium, and appear over the gluteal muscles.

Spinal abscess may pass directly backwards by the side of the spine and is then called a lumbar abscess.

Constant recumbency on the back favours the latter direction.

The abscess may burrow beneath the pleura, or may penetrate the cavity of the latter, or it may penetrate the lung. Patients have been known to cough up pieces of bone.

An abscess in the thorax will either follow the course of the aorta, passing through the aortic opening in the diaphragm into the abdominal cavity along the psoas, or if the opening through the diaphragm is not available it may pass upwards again.

Presenting in the lower abdominal region, an abscess may burrow upwards again beneath the abdominal muscles.

An abscess may open into the bowel and be discharged per rectum or find its way into the ureter and enter the bladder. A piece of bone may enter the bladder and form the nucleus of a calculus. (A remarkable case of this kind is recorded by Buckstone Browne.)

A case is described[1] of destruction of the two last dorsal and two upper lumbar vertebræ, in which an abscess ascended among the spinal muscles, and opened opposite the spinous processes of the last cervical and first dorsal vertebra.

In considering this subject it is well to remember that in any case a piece of bone detached from the diseased vertebræ may cause special symptoms, and give rise to considerable pain and irritation.

An abscess may find its way through the sacro-sciatic notch and present at the nates. In the latter case the collection of purulent matter will cause an obliteration of the gluteal fold by accumulating below the gluteal muscles. This effect and the resulting flexion of the hip joint may closely simulate hip joint disease. Moreover, the abscess may even penetrate to the hip-joint itself, ulcerating through the capsule, and may thus set up disease in that joint.

In the cervical region an abscess may appear at the side of the neck; often in the posterior triangle, in front of the

---

[1] *Pathological Society's Transactions*, vol. vii., p. 290.

trapezius, or at the posterior border of the sternomastoid, being directed by the position of the layers of cervical fascia. It may present at the posterior wall of the pharynx, and open into the throat. It may present directly backwards by the side of the vertebræ, or pass downwards into the posterior mediastinum, perhaps reaching the diaphragm, and opening into the pleura or pericardium, or outwardly between the ribs, or pass beneath the clavicle and open in the front of the chest.

Difficulty of breathing from direct pressure, or suffocation from the abscess entering the lungs, or embarrassment of the heart from direct pressure may occur.

When the abscess presents upon the posterior wall of the pharynx it may open suddenly and suffocate the patient by the matter entering the larynx.

A burrowing abscess may take other directions, and the surgeon must be always on the look-out for unusual places for its appearance.

The possibility of abscesses occurring independently of diseased bone, and especially in tuberculous patients, must not be forgotten. The following cases are examples.

Psoas Abscess from Tubercle of Kidney.[1]—The patient was aged 22 and had psoas abscess on the left side. He was in hospital a year, and died from exhaustion. The abscess was thought to be from disease of the spine.

Two or three of the lower dorsal vertebræ were carious, but there was no communication with the psoas abscess which came from the kidney and penetrated a few inches into the right psoas muscle.

Lumbar Abscess from Ryegrass.—Mr. Nicholls[2] recorded a case of a large lumbar abscess in which was found an ear of wild ryegrass, one inch and a-half long, which had been accidentally swallowed by the patient a few months before. He had vomited blood a fortnight before the abscess appeared, but there was no other sign of gastric irritation.

The possibility of an idiopathic suppuration of the spinal dura mater as recorded by Dr. Robert Maguire[3] must not be lost sight of.

---

[1] *Pathological Society's Transactions*, vol. xvi., p. 175.

[2] Brighton and Sussex Medico-Chirurgica Society, February 3, 1887.

[3] *Lancet*, July 7, 1888.

CHAPTER III.

OTHER DISEASES OF THE SPINAL COLUMN WHICH MAY SIMULATE CARIES,—OBSCURE CASES.

The following diseases are those which are most likely to resemble caries: (1) Cancer; (2) Rickets; (3) Syphilis; (4) pressure from an aneurism; (5) Hydatids; (6) Osteitis deformans; (7) Mollities ossium; (8) Osteo-arthritis.

Some of these are rare affections, but any one of them may give rise to deformity which may simulate caries. The most important of these is undoubtedly *cancer*, and therefore I shall describe several cases of this disease.

In *rickets*, although the deformity may appear like that of caries, yet the general symptoms will, as a rule, be easily distinguished.

Deformity of the spine from *syphilis* is a rare condition, but the case quoted is an important one.

Pressure from an *aneurism* may cause deformity, which possibly will give rise to some difficulty in diagnosis.

Hydatids is a rare disease in this country, but the cases I am about to quote show the kind of deformity which may occur, and should a patient present obscure symptoms, and come from Iceland, Silesia, or Australia, or even India, one might suspect the possibility of this disease.

Osteitis deformans causes a general rounding of the back, but there would also be an affection of other bones of the body, causing the characteristic bowing of the legs and arms, &c.

Mollities ossium and osteo-arthritis, and allied disorders are worthy of consideration.

Cancer.—Primary cancer of the spine is very rare. When the vertebræ become affected by cancer, it is generally secondary to cancer of the breast or some other part. In primary cancer the diagnosis may be very difficult, but we should look for *cachexia*, and there will probably be very acute local pain,

but the following cases will show that pain is not always a marked symptom, nor does the occurrence of severe pain exclude ordinary caries.

The body is liable to shorten by absorption of the bodies of the vertebræ as shown in the case illustrated in fig. 37.

Primary sarcoma may occur at an early age, and then symptoms may be very similar to those of caries. In some cases sarcomatous growths may give rise to swellings which may be mistaken for abscesses. Dr. A. B. Judson, of New York, records two cases, one in a child of 4 years 8 months old. Pain in the back had existed two months, and this child died ten days later. The second case was in a man aged 35, who had suffered pain in the lumbar region and thighs for about one year, and died five months subsequently. There was but little deformity in these cases, yet the symptoms had been attributed to caries. However, in the man Dr. Judson diagnosed malignant disease.[1]

Cancer may also occur in old age. Mr. Laurence Humphry narrated a case of primary cancer of spine[2] with slow compression of the spinal cord, occurring in a gentleman aged 72, active for his age, and engaged at his profession until his last illness. He had been under the care of Mr. Carter (Cambridge), for many years, and he was in moderately good health until June, 1882, when his first symptoms began. There was some previous history of a slight accident in which his back was said to have been jarred, the effects of which lasted for a few days. His sister died of cancer of the breast. In June he first began to complain of occasional pain in his back, and his friends noticed that he stooped more than usual. In October he went to London and consulted a physician, and the opinion formed was that the liver was at fault. The pain however became worse, and there was found to be an obtuse bend in the lower dorsal region of the spine, with projection of the spines of the five lower dorsal vertebræ; here there was also tenderness on pressure. The chief seat of the pain, however, was somewhat lower down in the lumbar region. In December there began to be some alteration in the character of the pain in the back. In addition to constant aching he

[1] *Transactions of American Orthopædic Association*, vol. iv., 1891.

[2] "Cambridge Medical Society."—*Lancet*, January 5, 1884.

was seized with *paroxysms of a peculiar kind, coming on usually at night or in the early morning*, in spasms of the *most severe pain in the stomach and loins, quite unbearable* and causing him to cry out and his back to become rigid, and then leaving him pale, exhausted, and covered with profuse perspiration to return again after an interval. Up to this time there was no sign of paralysis, and sensation was normal, but the pain extended down the legs and across the abdomen, as if the nerve trunks were in some way irritated. He was seen in consultation with Dr. Paget from time to time, and in December Dr. Bristowe was also called in, and the question raised of a new growth involving the spine and nerves. At the end of December the painful symptoms abated considerably, although not entirely, and he got up and walked about, and even went out of doors. The bowels were very confined, there was a constant feeling of sickness with a troublesome secretion of streaky mucus about the fauces. Now for the first time he noticed some weakness in his lower limbs and his gait became uncertain and unsteady. These latter symptoms increased very rapidly, so that in a few days he was quite unable to walk or turn himself over in bed. He was placed on a water bed, and there was no particular change in his condition for some weeks. The paralysis became more complete and the muscles soft and flabby. Sensation began now to be impaired and reflex action was slightly exaggerated. There was no great tendency to bedsores. *Emaciation was considerable, but cancerous cachexia was not a marked feature.* His mind was perfectly clear to the last. He became gradually weaker and died on July 1. The *post-mortem* examination revealed a sarcoma occupying the middle and lower dorsal region of the spine, and extending in and amongst the muscles of the back. On section the bodies and spines of the vertebræ were found softened and invaded by the new growth. The body of the tenth being crushed in, had given way, so that the spinal canal at this part was much narrowed, and the cord tightly nipped just above the lumbar enlargement. The growth had not attacked the meninges or nervous structures. There was no evidence of malignant disease elsewhere. Mr. Laurence Humphry drew attention to two facts of physiological interest, the retardation of sensation, and the interference with micturition; of the latter there was for the most part inability to pass

urine; as the disease advanced downwards there was inability to retain it.

At the Pathological Society (Novemer, 1891),[1] Mr. Jackson Clarke showed a specimen of lymphadenoma affecting the spinal cord, vertebræ, and lymphatic glands, from a woman aged 24, who first noticed a lump in the neck fifteen months before death, death being due to exhaustion. There had been slight pain in the back, and over the lower ribs of the left side.

Six months before death the abdominal prevertebral glands were enlarged and adherent to the vertebræ. Paralysis of the legs, pain and spasm also occurred before death. The affected lumbar glands were found to be matted together and adherent to the vertebræ which were infiltrated, and the body of the first lumbar vertebra was destroyed. The growth had extended into the intervertebral foramina, along the nerve roots implicating the dura-mater, the pia-mater and the spinal cord itself. It was pointed out that the growth differed from a sarcoma in that its vessels had walls of well defined structure.

Secondary Malignant Disease.—The following case illustrates the peculiar collapse and shortening of the spine from absorption of the bones, which sometimes occurs in cancer.

In the *Pathological Society's Transactions*, vol. ix., p. 234, a case is recorded of a man aged 28, who died from cancer of the liver. He also had cancerous deposits in the sternum and humerus of one arm and in the spine. At the *post-mortem*, "a soft tumour was situated along the right side of the lumbar vertebræ, and a section having been made in the mesial line, it was found to protrude into the spinal canal, and produce compression of the cauda equina, having destroyed a portion of some of the bodies and transverse processes of the vertebræ."

This patient had noticed a swelling in the abdomen and arm about two months before going to Middlesex Hospital. They had increased very rapidly. "He did not complain at first of any pain, except a deep-seated aching in the spine. Subsequently he had pain and tenderness over the enlarged liver." (See fig. 37.)

"He sank gradually and died on April 28, 1856, less than four months after he had first noticed the swelling of the arm."

In the following case the deformity was quite angular.

---

[1] *Lancet*, November 21, 1891.

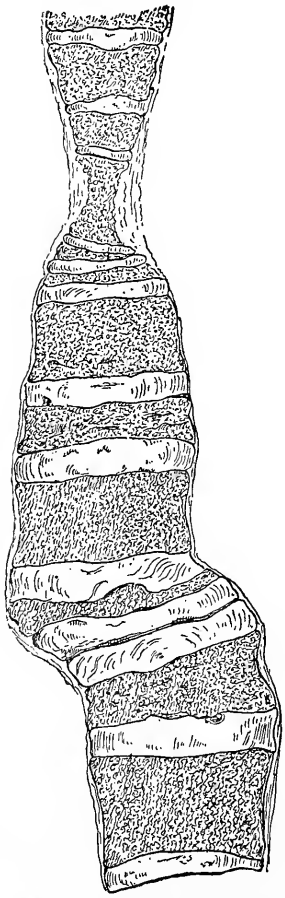


FIG. 37.

Middlesex Hospital Museum, No. 783.

"A section of a spine in the dorsal region. The bodies of the vertebræ have been infiltrated with cancer and have subsequently been removed by absorption. This change has proceeded to such a degree that the intervertebral discs which are scarcely affected have in two distinct places come into apposition. From a woman, Elizabeth Hill, aged 45, who suffered from scirrhus of the mamma which underwent atrophy. Lumbar pains, paraplegia and angular curvature followed, later on pulsating tumours appeared in the upper part of the sternum, in the cranium and ribs. At the *post-mortem* examination the left femur was found to be fractured, this probably occurred after death, but the bone was infiltrated with cancer.—See *Post-Mortem Register*, No. 1170, December 3, 1860, Series V., No. 628.

The patient died in St. George's Hospital and the deformed part of the spine is preserved in the museum.

The specimen is described as follows :—

"This preparation was taken from the body of Jane H——, aged 55, admitted November 28th, 1828. There was a total loss of sensation and of muscular power below the thorax; the bladder, rectum, and lower limbs being all paralysed, but the muscles contracted spasmodically when pinched and even when not touched. . . . . Violent pains in the abdomen and

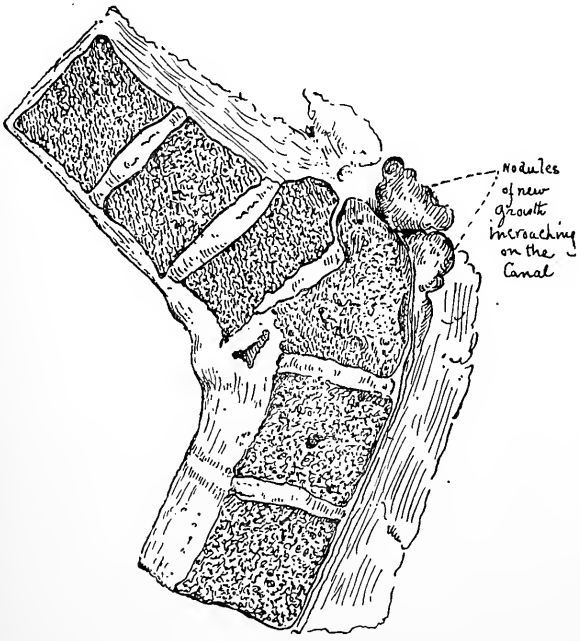


FIG. 38.

St. George's Hospital Museum (B. B. v. 51). Malignant disease of the spine producing angular deformity.

limbs. . . . . The urine was alkaline, and the temperature of the lower limbs higher than that of the upper part of the body. There was much pain on pressure being made along the spine, especially in the dorsal region, where a bend forwards had taken place, as if from loss of muscular power.

There were several sloughs upon the nates. Pain had been felt in the back eight months before her admission, followed in two months by numbness and soon after by paralysis. She had had the right breast removed for cancer seven years previously, and during the last six months, cancerous tubercles began to show themselves in the cicatrix, and enlarged glands in the axilla. She died from exhaustion caused by the sloughing, June 7th, 1829. *Post-mortem.*—All the bones of the spine were softened so as to cut more easily, and were more vascular and cellular than natural, and in cutting out the spinous processes there were found in some places in the osseous texture spots of yellowish substance. The sixth dorsal vertebra was most changed, and from its body there projected a firm substance in the form of three or four oval prominences which encroached upon the canal so as to compress the spinal marrow." . . . . . Three vertebræ in all were affected by the cancer, "the abdomen contained a small quantity of serum, but the peritoneum was almost everywhere covered by small tubercles, not extending into the viscera. They were hard and close-set, like grains of wheat, and a few rather larger . . . . . and many parts of the small intestines were quite matted together by hardening and adhesion of the tubercles. . . . . The axillary glands were of well marked cancerous appearance, very hard, and with bands going into the cellular membrane."

There is also a specimen at St. George's Hospital of primary medullary cancer in the three upper lumbar vertebræ. The body of the second lumbar vertebra has entirely disappeared, but the intervertebral cartilages remain entire. The bodies of the three inferior dorsal vertebræ as well as the lumbar were soft and could be cut with a knife.

The symptoms in this case were very obscure.

It will be seen from the above records that it must be a very difficult matter to diagnose cancer of the spine, in the early stages, from caries. If, however, there should be a doubt in the case, it is satisfactory to know that the treatment which should be adopted for caries will also be the best for cancer. The support will give some comfort to the patient, at least for a time.

The symptoms we may expect in cancer compared with caries are :—

1. More acute pain.

2. Rapid development of the disease, and especially as regards paralysis.

3. The failure of remedies to stop the progress (although support makes the pain more bearable).

4. Should there be or have been malignant disease elsewhere, this will add to the probability of the case being one of cancer.[1]

FIG. 39.

FIG. 40.

5. Often there is little or no angular deformity or kyphosis, but in such cases we may observe shortening of the vertebral column from absorption of the whole of one or more vertebræ, as shown in the above drawing (fig. 37).

Rickets.—The spine in rickets is apt to curve posteriorly, giving an appearance which might be mistaken for caries.

[1] See also "Cases of Malignant Disease of Vertebræ with Paraplegia Dolorosa," by R. T. Edes.—*Boston Medical and Surgical Journal*, June 17, 1886. Also "Malignant Disease of the Spine," by R. W. Amidon.—*New York Medical Journal*, February 26, 1887.

The presence of rachitic changes in other bones, and the general characteristics of the disease, which are commonly present, will help in the diagnosis. In those cases of rickets where the patient suffers from pain (especially in scurvy-rickets) the case may be easily mistaken for tubercular caries. Associated with rickets is the following case which I have described in "*The more severe forms of Lateral Curvature.*"

Master B——, aged 9, sent to me by Dr. Russell Reynolds, April, 1890. The looseness of the joints is well shown in the hands and fingers in fig. 39. He walked with great diffi-

FIG. 41.

Patient could walk only in this way before treatment was commenced.

culty, supporting himself by his hands resting on his knees, with his body much bent forward. He could not stand upright. I was informed that he was quite helpless in getting in and out of his bath, and could not attend to the functions of the body without assistance.

He derived a great deal of help from the use of an instrument. Two months after his first visit to me I was told that he could then manage quite easily for himself in every way, while before he was "as helpless as a little baby."

1892.—He had continued to improve in every way; the photograph (fig. 42) shows the alteration in his figure, and also that he can now stand comparatively upright.

Syphilis may be the cause of caries, and is supposed to be so in many cases of atlo-axoid disease. Personally I have not recognised this cause in the cases of disease of these upper two vertebræ which I have seen, and in fact in those cases

FIG. 42.
Appearance of Master B——, in June, 1892.

there has been no symptom whatever of syphilitic disease. Upon the other hand, in an instance in which I attributed the disease to syphilis, the dorso-lumbar region was the part affected, and there was a peculiar irregularity of the whole dorso-lumbar spine. The following illustration is after Fournier.[1]

It was in a man aged 56, who exhibited many other symptoms of advanced syphilis; he was suffering from "syphilitic

[1] *Anal. de Dermatologie et de Syph.*, January, 1881.

sarcocele, ten cutaneous gummata, as also in the muscles and a gummous ulceration of the great toe, also a macula on the thigh." This patient soon after died.[1] The case is referred to in Holmes' "System of Surgery," third edition. After death there was found "characteristic cicatrices on the spleen,

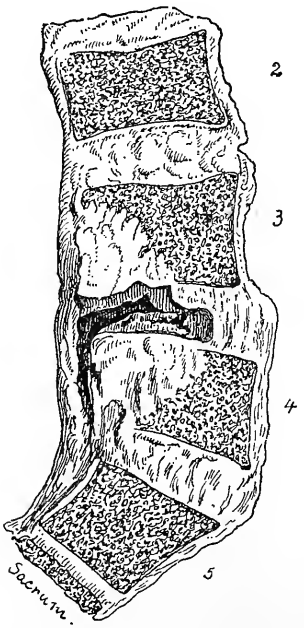


FIG. 43.

"The deposit is softening at its centre, and its products are working towards the posterior common ligament. There was also gummatous deposit in the roots of the nerves given off here."

gumma of the fourth lumbar nerve, multiple and considerable lesions of Pott's disease affecting the lumbar column, especially the third, fourth and fifth vertebræ of that region. These consisted of denudations of bones, thickening or destruction of the periosteal and ligamentous structures, sclerosing osteitis with caseous and purulent infiltration, almost complete destruction of the intervertebral fibro-cartilage, and

[1] See "Obscure Disease," p. 78.

a vast hollow mass in the lumbar column, also an abscess in each psoas muscle."

"A careful microscopic examination showed the deposit in these bones to be clearly gumma in various stages of degeneration; also that there were many gummatous nodules in the nerves passing off from this region." In figure 43, it may be

FIG. 44.

Part of the spine from a sailor, aged 36, who died in St. George's Hospital after symptoms of rather more than two years' duration.

noticed, "that the disease lies on the posterior aspect of the bodies where any injury would be most unlikely to affect the bone. Nor was there any history of injury in this case, nor any reason to suppose that such had taken place. The disease had manifestly originated in both instances in the breaking

down of a special deposit infiltrating the osseous tissue of the part."

Pressure from an Aneurism.—Fig. 44 (on preceding page) represents a specimen in St. George's Hospital Museum, which well shows the great destruction of bone which may occur from this cause.

Pain was prominent from the first, and was localised in the hypochondria, the epigastrium and subsequently in the shoulders. About a month before death severe pain occurred suddenly in the left lumbar region, extending in all directions, and was "excruciating" until the fatal rupture.

The erosion extends from the third to the twelfth dorsal vertebra, but it will be noted that the intervertebral fibro-cartilages remain intact. Two aneurisms were concerned in the process.

In any case when deformity has been produced in this manner, the presence of the aneurism will probably have been clearly recognised long before, but in the early stages when only pain is present, there may be some difficulty in diagnosis as shown in the following instance.

A case was brought before the Clinical Society by Mr. Spencer,[1] which shows that aneurism may occur and press upon the spinal cord without being diagnosed, and certainly without producing any appreciable pulsation. It had been previously referred to in volume xxiii. of the *Clinical Society's Transactions*. The aneurism seems to have been caused by a fracture dislocation of the spine at the junction between the dorsal and lumbar vertebræ in a man who had fallen thirty feet.

Hydatids[2] (the cystic stage of tænia echinococcus).—Hydatids are so uncommon in Europe that we do not often meet with a case of this disease, unless the patient should come from a country where it is more prevalent. There would always be a difficulty in diagnosis.

The following figure I have drawn from a preparation in Guy's Hospital Museum (1029[35]).

The case was that of P. P——, aged 58, under the care of

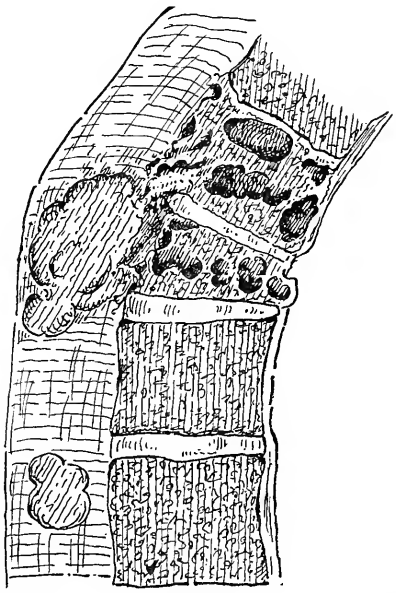
---

[1] Reported in *British Medical Journal*, December 5, 1891.

[2] Very well described by Mr. Bland Sutton, in his recent work on "Tumours."—*Cassell & Co.*

Dr. Wilks. Symptoms had lasted eleven months, and there was severe pain followed by paraplegia. It will be observed in this specimen that the curve produced by the disease is very similar to that of an ordinary case of caries.

The eleventh and twelfth dorsal vertebræ are eroded by hydatids extending into the tissue round the spinal column, compressing the cord by bulging the dura-mater against it, undermining the pleura. Some of the hydatids are to be seen



1029 35.

FIG. 45.
Hydatids of Spine.

under that membrane. They showed no hooklets nor heads, and they budded from each other's outer surfaces.

No other hydatids were present. Death followed paraplegia, and sloughing of the bladder.

Fig. 46 (St. George's Hospital Museum, 14[a]) represents another case of hydatids. They had developed in the spinous process of the seventh cervical vertebra, extending to the body of the bone. The cavity formed in this part communicated with

another cavity situated on the side of the same vertebra; two of the foramina for the passage of nerves have been converted into one. The cavities are lined by a membrane which contained more than 100 hydatids. In the cancellous structure of the body of the vertebra there are also a few hydatids. The bone around the cyst is perfectly healthy but the tumour projected inwards upon the spinal marrow. For several years the symptoms had been attributed to caries.

In this case I should, in consequence of the thickening of the spinous process have drilled into it, and that would have disclosed the nature of the case, and would have enabled one to evacuate the contents, and possibly to have produced a cure. See p. 109, under "Drilling."

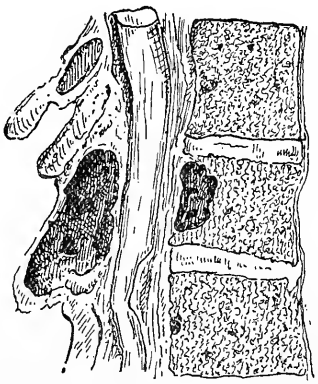


Fig. 46.
Hydatids of Spine.

Osteitis deformans.—This disease, first described by Sir James Paget, is a chronic inflammation of the bones. The deformities produced are very remarkable and characteristic. The skull is enlarged, the spine bent, and the legs curved, the patients assuming remarkably similar appearances in nearly all the cases that have been recorded.

The cause of this disease is not known. In many of the cases it has been associated with cancer. The bones are much enlarged as well as bent, and are always extremely tender. The general health does not suffer.

The spines of these patients slowly curve and become rigid. In Sir James Paget's first case "the whole of the cervical vertebræ and the upper dorsal formed a strong posterior, not angular, curve; and an anterior curve of similar shape was formed by the lower dorsal and lumbar vertebræ." The chest became "contracted, narrow, flattened laterally, deep from before backwards, and the movements of the ribs and spine were lessened. There was no complete rigidity as if by union of bones, but all the movements were very restrained, as if by shortening and rigidity of the fibrous connections of the vertebræ and ribs."

FIG. 47.

Sir James Paget's first case. Disease began at age 46, and he died at the age of 68.

I will now record a case of a lady who was sent to me by Dr. Spender, of Bath, and Dr. Alfred Meadows, November, 1882.

Miss B., aged about 60. She lost the power of walking (for more than a few paces at a time) twenty years before, in consequence of an accident which caused sudden displacement of the uterus. After a long treatment she was at last relieved from the pain and discomfort three years before I saw her, but still the inability to walk continued. This was attributed to general muscular weakness from the long-continued inaction,

until the legs were examined, when the real nature of the disease was discovered. Pains in the left knee commenced about a year before. This patient was remarkably bright and cheerful.

The spine was curved in consequence of the head sinking forwards, just as in Sir James Paget's case, but there was not the incurvation of the lower part of the spine which he described.

Miss B. complained of distress and difficulty in breathing, occasioned by the bending forwards of the head. The general health seemed good, and the urine was healthy.

Mechanical apparatus was not applicable, in consequence of the tenderness of the bones, but a specially constructed chair and couch to relieve the weight of the head from falling forward was beneficial.

Osteo-malachia.—In this disease there is an osteo-porosis or an absorption of bone, and the whole skeleton is generally affected. It is said to occur chiefly in pregnant women, but it is a rare disease and hardly likely to be mistaken for caries.

Osteo-arthritis and allied disorders.—The name osteo-arthritis is sometimes assigned to the disease of the joints, otherwise known as *chronic rheumatic arthritis*, formerly as *rheumatic gout*. It will be useful to include under this definition all those cases in which an inflammatory process, either rheumatic or gouty, or allied constitutional condition, occurs in and about the joints of the spine, causing an outgrowth of bone commonly described as a "liping" of the margins of the joints, and frequently terminating in ankylosis. Specimens are not infrequent in museums of kyphotic spines in which this condition exists. They are generally allied with old age, but not exclusively. I have seen middle-aged and sometimes quite young people, I mean about 30, the victims of gout or chronic rheumatic arthritis, in whom the spine has been rounded and rigid, but I may add that in such cases there has not often been any difficulty in forming a diagnosis. I remember, however, the case of a lady, aged about 45, in whom the kyphotic spine and the constant pain together with some œdema in the mid-dorsal region gave at first an appearance of caries, but her own history of gout, and the fact that her ancestors and blood relations were an extremely gouty family, helped me materially in forming what I think proved to be a correct diagnosis.

OBSCURE DISEASE OF THE SPINAL COLUMN.

Under this heading I am about to describe some cases in which caries of the spine has existed, but has either not been recognised during life, or in which the symptoms have been of an uncertain character.

In almost every case there have been some symptoms of caries, but they have not been thought sufficiently characteristic to lead to a definite diagnosis. The complete, or almost complete absence of pain has often led the surgeon to ignore the probability of the cases being caries, and peculiarity in other symptoms has also given rise to difficulties in forming a decided opinion.

Some of these cases show that caries may progress to a very advanced stage of destruction of bone, and that a patient may die from its effects without the nature of the disease being recognised.

Caries with absence of pain.—March 6, 1884. Child aged 5. Angular projection of the spine, undoubtedly a case of caries. Projection first noticed when the child was two years old, and increasing ever since, but *there had been no pain whatever.*

I have met with a considerable number of cases of this kind, some of which are recorded below under "Cases" (see especially case of December 2, 1884), but I would rather base my observations upon the examination of morbid specimens in our hospital museums, which prove the facts conclusively, and also from cases recorded by other surgeons.

Extensive Caries unrecognised during Life.—In St. George's Hospital Museum, 2A or V. 156, is a specimen in which "the lateral masses of the atlas"—I quote from the catalogue—"are extensively destroyed and the tubercles for the attachment of the transverse ligament quite gone. The superior articular processes of the axis are greatly, the left almost entirely, worn away. The odontoid process is reduced to half its natural size. The posterior ligament remains intact, but the transverse and check ligaments have been completely destroyed."

From a boy aged 8.—The report states: "This case is of interest, as showing how large an amount of disease of the atlas and axis may exist without giving rise to any of the

ordinary or characteristic symptoms of disease of the cervical spine. The possibility of the existence of such disease was not overlooked: but, on the contrary, was constantly," the writer observes, "before my mind, and led to repeated and most careful investigations, with a view to its discovery, but these failed entirely to elicit any signs of its presence.

"There was no pain on rotating, or nodding or pressing the head; no difficulty in raising it; none of the characteristic fear of moving the head; no thickening over the bones; no

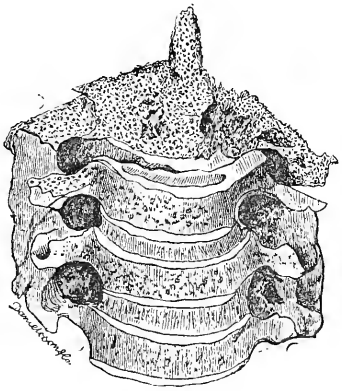


FIG. 48.

Second to seventh, cervical vertebræ, the atlas being considerably destroyed by caries. Anterior view.

tenderness or swelling behind the pharynx; in fact, until the end of the boy's final illness nothing but wry neck." . . . "I need hardly say," proceeds the writer, "that had I been aware of this, I should not have allowed him to move his head nor to leave the recumbent posture."

We ought to learn a lesson from this case; and to consider that although the symptoms were so unlike what we have been taught to expect, yet the fact that they were so soon relieved by fixation and recumbency, and rapidly recurred when the patient began to move about again, were then relieved a second time by recumbency in a fixed position, after six weeks of which the patient was seen with "the head held straight but stiffly, after the manner of one with cervical spine disease," ought to have been considered indicatory of the nature of the

case. It was not, however, so considered, and the child was allowed to get about. The disease consequently increased, and death ensued.

Caries unrecognised during Life.—Another case in St. George's Hospital Museum is that of No. 2B. There exists caries "of the bodies of the upper four cervical vertebræ and inter-vertebral cartilages, communicating with an ulcerated opening at the back part of the pharynx. The membranes of the spinal cord were in this situation united to each other, and to the posterior surfaces of the vertebræ. The upper part of the spinal cord was softer than natural. The symptoms produced by the disease were so slight that the ulcer of the pharynx was not, previous to the patient's death, known to have any communication with the bones of the spine. The patient died suddenly."

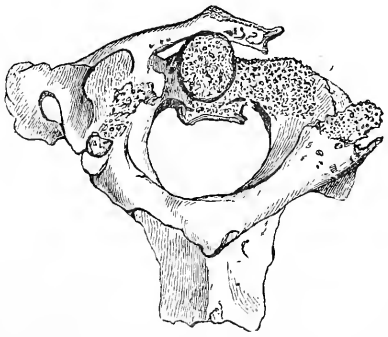


FIG. 49.

Diseased Atlas and Axis seen from above.

Very extensive destruction by Caries unrecognised during life.—A very remarkable case is that of the late Dean Buckland, of Westminster, who died in 1856, aged 52. The upper part of his spine is preserved in the Museum of the Royal College of Surgeons (No. 2064A, old number).

The preparation consists of "The five upper cervical vertebræ" (only the atlas and axis are here shown), "with a portion of the occipital bone, affected at several points with carious ulceration. The right transverse process and both upper and lower articular surfaces of the same side of the atlas, are entirely destroyed. The corresponding condyle of the occipital

bone is also diseased, and the articular surface of the axis, the right transverse process of the third vertebra, and the left occipito-atlantoid articulation." This description is taken from the catalogue, which further records that "no other symptoms manifested themselves during life but those attributed to melancholia." (See figs. 48 and 49.) A more detailed account is recorded in the *Pathological Transactions*, vol. xv., p. 20.

Caries mistaken for Hydrocephalus.—In the Royal College of Surgeons Museum, No. 2093, is the specimen of a very remarkable case in a child about 6 years of age, in whom "the symptoms were supposed to be those of hydrocephalus. A swelling occurred at the side of the neck.

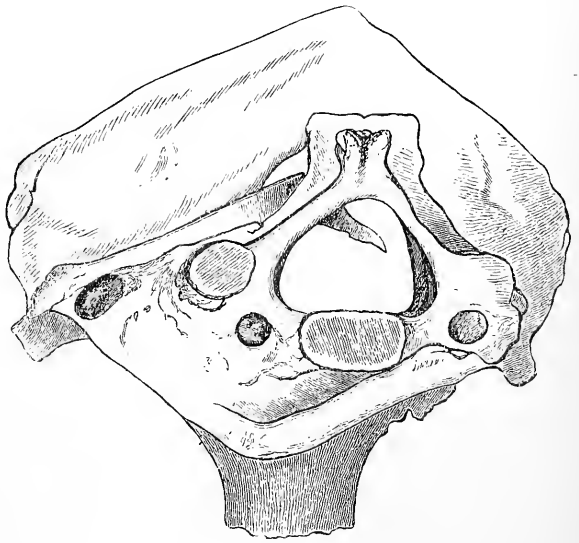


FIG. 50.

The first two cervical vertebræ and the base of the occipital bone seen from below. The displacement of the vertebræ and their consolidation after inflammation is clearly shown.

The child steadied its head with its hands, and moved very cautiously. The symptoms gradually ceased, and the child regained health, but died at the age of 12, from lumbar caries. The *post-mortem* examination showed the great displacement of the upper two vertebræ from disease. There had been no hydrocephalus." Here were some of the characteristic symp-

toms of diseased vertebræ, but probably because of the absence of other symptoms the nature of the disease was overlooked.

Caries Mistaken for Croup.—In Guy's Hospital Museum, No. 1080[85], is a specimen in which the fourth dorsal vertebra is quite destroyed, and those above it partially so by caries. The child was 6 years old, and was admitted with "urgent symptoms of croup." He died, but the respiratory organs were found quite healthy, whilst behind the œsophagus, and opposite the diseased bones, there was a large abscess communicating with the diseased vertebræ.

Caries unrecognised during life.—Another specimen in St. George's Hospital Museum (No. 3569, old number), is the spine of a woman of 60, admitted for paraplegia of three months' standing, and who died suddenly. Examination of the spine during life failed to afford evidence of vertebral disease. The

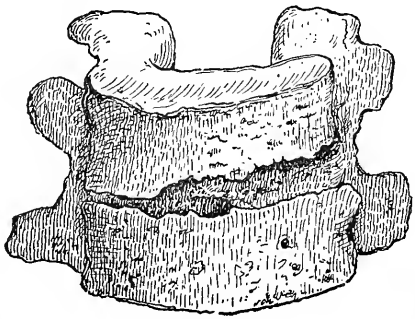


FIG. 51.

From St. George's Hospital Museum.

(1B) Two lumbar vertebræ, the inter-vertebral cartilage between them having been destroyed by ulceration. The bones in this case are but slightly affected by caries. Presented by Sir Benjamin Brodie.

contiguous portions of the bodies of the third and fourth dorsal vertebræ are partially destroyed, and the inter-vertebral substance completely so. In regard to this case it may be remarked that although pain may be present during the early stage of the disease, its cessation is not necessarily a proof that consolidation of the bones has taken place.

Caries with absence of deformity.—Very severe caries may exist without any deformity being present. The cases illustrated in figs. 25, 26, and 33 show degeneration of bone

to a very extensive degree without the production of characteristic deformity. In the instances of this kind which I have met with, the general giving way of the whole spine from weakness, the pain, or some other symptom, have clearly indicated the nature of the disease, and if the surgeon bears in mind the fact of the spine being attacked in this manner he ought not often to make a mistake. Figure 51 represents a specimen in which probably there was no deformity, and as the extent of the disease is so limited it is quite possible there may have been an absence of pain.

Four Unusual Cases of Spinal Caries under the care of Mr. James Allen in Wandsworth Infimary.[1] These cases are interesting and instructive on account of: (1) The ages of the patients; (2) the small degree or absence of deformity; (3) the severity and peculiarity of symptoms which might have been attributed to other causes; (4) the necropsies.

Case 1.—*Caries of dorsal spine, paraplegia.* William S., aged 69, was admitted on December 29, 1879. In December, 1878, after exposure to cold and wet, the patient felt pains across the lower part of the back. This did not incapacitate him from acting as a messenger until nine months later, when the inferior extremities became weak and dragged slightly. Sensation was impaired; numbness, first noticed in the toes and crept up both limbs simultaneously. He had slight starting of the limbs, chiefly at night, straining on micturition (urine passed most freely in the morning), and soon afterwards constipation. Rapid increase of these symptoms took place during the week preceding admission; but he was not confined to bed. On examination motor power and sensation of the lower limbs were very limited and reflex action was increased. There was pain in the lumbar spine; the patient could sit up in bed without difficulty. The urine was normal, bowels constipated. On January 12, he had retention of urine, necessitating the use of a catheter. On the 17th, he had complete motor paralysis, with painful starting of limbs. On February 1, incontinence of urine came on, the bowels were moved only by enemata. On the 19th, the urine was ammoniacal and there was a sensation of constriction round the abdomen together with prominence of one of the lower

[1] Recorded in the *Lancet*, June 25, 1881.

dorsal spines. On March 19, the skin over the sacrum had given way; there was much pain shooting round the upper part of the abdomen from the level of the two lower ribs; sensation in the limbs was quite abolished; reflex action was increased, anorexia. He was easiest when propped up in bed, pain was relieved by opium and by small blisters applied near the spine, temperature subnormal. On March 25, the patient died exhausted.

Necropsy.—Removal of the thoracic viscera exposed at the lower part of chest, two rounded tumours, one on each side of the bodies of the tenth and eleventh dorsal vertebræ; contents fluid and communicating with each other across the middle line. There was about an ounce of thick pus mixed with bone fragments; the cartilage between the tenth and eleventh dorsal vertebræ had disappeared; the tenth vertebra was ulcerated away in its lower surface, but to a much greater extent anteriorly than posteriorly, and presented an irregularly convex outline fitting into a corresponding concavity in the upper surface of the eleventh vertebra, which was not much wasted; and the opposed surfaces were tolerably firm, covered here and there with small patches of cartilage. The tenth dorsal spinous process was slightly prominent; on removing the spinal arches the body of the tenth dorsal vertebra was found *projecting somewhat backwards inferiorly.* Above this projection the membranes and cord were normal; below, the dura mater was much thickened and adherent to the spinal canal by means of an inspissated layer of pus, mixed with bone spiculæ; the cord was slightly softened, but not adherent. At the apices of the lungs there was evidence of old cured lung disease, bladder hypertrophied; pus in pelvis of left kidney; small granular kidneys.

Case 2.—Caries of twelfth dorsal and first lumbar vertebræ; no paralysis.—Henry C., aged 55, was admitted on September 3, 1879. About four years before, he fell from a considerable height on his back; for the last two years he had experienced weakness and pain in the lumbar region. On examination the last dorsal spinous process was slightly prominent; pain on pressure or movement and rigidity of the spine were also noticed. The urine was normal. While under treatment he frequently had intractable pain in the area supplied by the lateral branch of the last left dorsal

nerve. The movements of the left thigh caused pain, and he could not turn readily in bed.

No paralysis or difficulty with bowels or bladder, occasionally free from pain, not usually confined to bed. He was relieved by chloral and by blisters; his condition was aggravated by opium; died rather suddenly from pneumonia on May 30, 1880.

Necropsy.—The right lung weighed fifty ounces, and was in a state of red hepatisation. There were caseous nodules in the apices of both lungs. There was prominence of the twelfth dorsal spinous process, and slight displacement backwards of the twelfth dorsal vertebra. Over a limited area anteriorly, opposite a large carious cavity in the contiguous surfaces of the twelfth dorsal and first lumbar, the dura mater was thickened and encrusted with a layer of thick pus and bone spiculæ, and adherent to the spinal canal. Cord normal. On dissection from the abdomen it was found that no disc existed between the above-mentioned vertebræ, and that a large portion of both bodies had broken down; the space so formed was occupied by thick pus and bone débris; pus had burrowed along each side of the spine in the psoas muscles as far as the third lumbar vertebra; the greater quantity of pus was on the left side, tilting forward the left kidney. The upper surface of the first lumbar presented a concavity excavated to almost the whole depth of the bone, and the under surface of the twelfth dorsal was so fashioned as to fit into it. The carious surfaces were soft and readily broken into. Large white kidneys, 7 oz. each; liver, 4 lb., fatty.

Case 3.—*Superficial caries of fourth and fifth lumbar vertebræ. Tuberculosis.*—James W., aged 67, was admitted on April 30, 1880, on account of a carious cavity in the shaft of the right tibia, near the upper extremity, of ten years' duration. While under observation he was feeble, appetite poor, lost flesh, and complained of pain across the lower part of lumbar spine. His chest was emphysematous, but nothing further was detected until a few days before death, when crepitation, dry and small, was heard all over both lungs; resonance not impaired. Ten hours before death on August 5, 1880, he had a series of convulsive fits, and became unconscious. The fits recurred frequently; consciousness was not recovered; convulsions general and rather violent.

Necropsy.—Several minute hæmorrhages were found in the course of the vessels at the base of the brain, and especially in the Sylvian fissures; none in the cerebral tissue. Both lungs free in the chest; right weighed 29 oz., left 22½ oz.; both throughout in a state of acute miliary tuberculosis. Heart weighed 10 oz.; right auricle contained a large firm white clot; valves competent. Liver, spleen and kidneys amyloid; in the liver and kidneys there were several minute purulent collections. Superficial caries of the fourth and fifth lumbar vertebræ, an abscess situated anteriorly and connected with the bare bone, containing about 3 oz. of pus, thick, not mixed with bone fragments, entering each psoas muscle, and running in the direction of the muscular fibres, causing considerable destruction of tissue. The carious cavity on the inner surface of tibia reached deeply into the head of the bone.

Case 4.—*Caries of dorsal spine. Paraplegia.*—Mary H., aged 68, was admitted December 8, 1880. For three weeks she had felt ill, and on admission exhibited symptoms of gastro-hepatic derangement, foul tongue, tenderness on pressure over stomach and liver, nausea and constipation. The urine was slightly alkaline. On December 14, she had neuralgic pains in the left upper part of abdomen, relieved by blisters applied near the spine. Two days later there was pain on pressure over the lower dorsal vertebræ. On January 27, there was some loss of motor power in the lower limbs, attended with cramp; the bowels were confined. On February 2, there was complete motor paralysis of inferior extremities, abolition of sensation, sole reflex subnormal, patellar reflexes normal, painful involuntary flexions of the limbs (pain referred to spine, hips, and abdomen), and loss of sensation in lower part of abdomen; incontinence of urine; bowels moved only by enemata. On February 9, there was flatulent distension of the abdomen. The pain was relieved by opium. Later the patient had a bedsore, and for a month before death the bowels acted spontaneously. Death took place from œdema of the lungs on April 24, 1881. A daughter died of hip-joint disease and a son of hæmoptysis. No history of injury.

Necropsy.—After removal of the spinal arches, on raising the dura mater, it was found adherent anteriorly to the body of the seventh dorsal vertebra, much thickened at this part and encrusted with caseous pus. At the seat of this lesion the

cord was slightly softened and considerably lessened in bulk, but not adherent to the membranes. There was a carious cavity in the seventh dorsal vertebra. A small soft tumour behind the descending aorta indicated the situation of the affected vertebra, and was due to a local collection of thick pus and bone fragments occupying the cavity in the body of the seventh vertebra, and bulging anteriorly. With the exception of the upper and lower epiphysal plates, the body of this vertebra was almost entirely gone; the inter-vertebral fibro-cartilages were not affected. Lungs emphysematous and œdematous at dependent parts; a multilocular par-ovarian cyst on the right side, size of a large orange; the left ovary was implicated in a simple cyst of like dimensions. Fourth ventricle of brain small; central canal not patent at the calamus scriptorius.

Caries in which vomiting was the most important symptom.—At the Cambridge Medical Society, November 2, 1883, Mr. Stear, of Saffron Walden, "related the case of a medical man who died in June, 1883, aged 51. He had always been a strong man, and worked hard at his profession, without ever taking a holiday. During the last four months in 1882 it was noticed that he was thinner and looked aged, but he could ride twenty miles without fatigue. At the end of January he caught cold and was confined to his bed with severe rheumatic pains in the right gluteal region. After a brisk purge he was better and able to get up, but he did not make much improvement. On February 5th, he was seen with Dr. Latham, the symptoms being vomiting after dinner and pain in the hip and thigh. He left home for Ventnor, and afterwards went to Clifton, and returned home much emaciated and very weak. He was seen again by Dr. Latham, but no tumour or evidence of spinal disease could be discovered. On April 8, Dr. Humphrey opened an abscess which had been detected in the back, a large quantity of laudable pus escaping. The disease continued until his death on June 25 from exhaustion. At the *post-mortem* examination there was found to be extensive disease on the right side of the bodies of the second, third, and fourth lumbar vertebræ, and erosion of the transverse processes of all of them, extending half way along the crest of the ilium. The iliacus muscle had disappeared, and its sheath was filled with pus. There was also pus in the psoas muscle. The car-

tilages were healthy. The stomach was dilated. All the other organs were healthy. Mr. Stear thought it probable that the spinal disease was caused by a fall from a horse, or at lawn tennis in 1882. The case was of interest from the deceptive nature of the cause of vomiting and emaciation, and from the fact that although there must have been extensive disease of the vertebræ, he was able to carry on his work."

Caries without ordinary symptoms. Sudden death.—Mr. Samuel Buckley, Surgeon to the Manchester Clinical Hospital, describes the case of John Isherwood, aged 7, who was admitted into the Preswich Workhouse Hospital "in a debilitated condition and suffering from an attack of bronchial catarrh." At the end of a month he was much improved, and expressed himself as feeling quite well. "Whilst at tea with the other convalescents, during somewhat boisterous laughter, with his mouth full of food, he had a fit of coughing, followed by symptoms of suffocation, apparently due to the irritation of food having gone "the wrong way." One of the inmates slapped him on the back with the idea of relieving him, when the child fell down dead."

An inquest was held, and Mr. Buckley made a *post-mortem* examination, and found that death was due to asphyxia, caused by an abscess which was present behind the larynx and pharynx.

"It was seen to bulge up from between the longus colli, lying upon the anterior vertebral muscles, with a flattened contour, and extending down to the fifth cervical vertebra. Its walls were thick and unbroken in front, being formed by the anterior vertebral ligaments, *plus* adventitious tissue. It contained about five or six spoonfuls of thick pultaceous, cream-coloured, purulent liquid slightly mixed with a gritty detritus. It was found to arise from caries of the bodies of the second and third and slightly of the fourth cervical vertebræ and intervertebral fibro-cartilages. The axis was fractured. The odontoid process was broken off from the body of the axis, being partially eaten through with caries, and the atlo-axoid ligament had separated from its attachment to the body of the axis, the atlas, with the odontoid process below and the cranium above, being dislocated forwards over the axis, producing pressure upon the cord, and consequently fatal asphyxia. The cord and its membranes presented a healthy appearance.

The only symptom which had been observed was stiff-neck, from which he seemed to have suffered at various times."

The report also states "the lad was of a strumous habit, having had enlarged cervical glands in infancy, and a strumous father."

Severe case, unrecognised during life.—A remarkable case is recorded,[1] which was under the care of Mr. Makins, at St. Thomas's Hospital, in a woman aged 37, in whom there was caries of the fifth lumbar vertebra, leading to chronic rectal obstruction with extensive destructive ulceration in the perineum. It is stated "that no symptoms were present to point to spinal caries except the perineal ulcer; and this from its shallowness, wide superficial extent, and general unlikeness to the fistulæ often giving vent to fæces usually met with, together with the small amount of discharge, was of little diagnostic aid. A thorough rectal investigation might, no doubt, have thrown more light upon the case, but this, unfortunately, was impracticable, as any examination caused extreme pain, and the patient's general condition was so serious as to preclude anæsthetisation unless absolutely necessary. . . . Vertebral disease being unsuspected, the main diagnostic interest centred in the nature of the ulceration. The appearance negatived at once the question of epithelioma, although the ascites, the pressure of the left iliac vein, and the enlargement of the superficial abdominal veins, still left the possibility of internal malignant growth, even in the absence of a palpable tumour, &c."

Necrosis of a Lumbar Vertebra. Rapidly fatal result.—This case was recorded by Mr. James Y. Totherick, honorary physician to the Wolverhampton General Hospital. A young gentleman, aged 15, had been complaining for some days of pain in the stomach, but was doing his school work as usual. The next day, not feeling so well, he kept his bed. He then complained of severe pain in the back, which was tender to the touch, and in the abdomen, which was distended. His temperature was raised, and his pulse quick. He could give no history of any injury.

Abdominal distention, and the pain and tenderness in the dorsal region increased. Temperature 102.5°; pulse 100.

[1] *The Lancet*, May 5, 1888.

Patient was restless, flushed, and moaning with pain, and impatient at being touched anywhere. Extreme pain about the abdomen, and in the lower dorsal region and the back for about three inches on each side of the spinal column. Leeches gave temporary relief. Patient, the next day, became delirious, and continued in that condition for two days. Temperature had risen to 103°, but next day was 100°. The tympanites and most of the tenderness of the abdomen had disappeared. Bowels opened naturally. Urine had to be drawn off night and morning. Swelling and tenderness appeared in the left elbow joint. The next day a red painful swelling appeared in the first two knuckles of the left hand, and in each place there was fluctuation. "It was now evident that we had to do with a case resembling pyæmia." Quinine and stimulants gave temporary relief. Temperature again rapidly rose, and he died quietly on the seventh day after being first seen.

Autopsy.—In the upper lobe of the left lung were numerous small white lobules, some of which contained liquid pus. The right lung was crepitant in the upper lobe, and emphysematous. Yellowish soft patches, some purulent and some apparently caseating, existed in other portions of the lungs. In one spot of the liver was a collection of pus about the size of a shot. The joints of the hand above referred to were found to contain thick collections of pus; there was also pus in the elbow joint. "On cutting through the spinal muscles pus welled up in large quantities. The periosteum of the spinal canal was intensely inflamed, and the canal external to the cord was filled with pus, which was also infiltrated amongst the spinal muscles, but the visceral surface of the membranes of the cord was free from inflammation, and healthy.

"The body of the first lumbar was found to be quite soft and infiltrated with pus, presenting internally a marked contrast with the vertebra above it and the one below, both of which were hard and of a dark, livid colour."

As regards the condition of the lungs, "during life the breathing, beyond being a little hurried, was only slightly affected, and only a few mucous râles were audible on auscultation, except on the last day, when some dulness was discernible." The writer added, "What caused the acute necrosis of the lumbar vertebra? There was no history of a blow or of a sprain, or even of a strumous tendency."

It is not at all unlikely that this patient may have been kicked, or in some other way injured, by a schoolfellow some time previously, and that the osteitis had progressed without any very severe symptoms until septic absorption happened to occur. School boys cannot be trusted to tell (what they consider) tales of their schoolfellows.

A case of Periostitis of the Spine accompanied by Tetanic spasms (probably Syphilitic).[1] — Dr. William Budd, of Exeter, records a case of a gentleman of active habits who had suffered for nine months from symptoms of periostitis. The spine and the bones of the pelvis were the parts chiefly affected. Upon examination "there was much tenderness in the spinous processes of the third and fourth dorsal vertebræ and also in the sternum. He had also suffered severe pain in his limbs and trunk generally, which the least motion aggravated; coughing, sneezing, or laughing produced agonies of pain in the back and ribs. The pains were greater at night."

A few days before being seen by Dr. Budd "he became affected with sudden attacks of tetanic spasms, which fixed his limbs and extended his trunk, throwing his head back. It was a sudden shock, which relaxed again instantly. He found that the best way to avoid their recurrence was to lie on his back and remain perfectly still."

There was some history of syphilis for which he was treated and was salivated. Upon this history Dr. Budd gave five grains of iodide of potassium and five grains of Plummer's pill every night at bed time. "After taking these for a fortnight, he was greatly relieved in all his symptoms. The tetanic spasms had not returned since taking the medicine. A fortnight later he was entirely relieved from his symptoms, and had gained strength and flesh." The next time Dr. Budd saw him he described himself as perfectly cured.

---

[1] *British Med. Journ.*, September 6, 1885.

CHAPTER IV.

TREATMENT.

The chief object of treatment is to obtain resolution of the inflamed and ulcerated parts, with as little deformity as possible. Whatever may be the condition of the health of the patient, however advanced the disease, the object remains the same; to subdue the inflammation, and to obtain consolidation of the diseased bones.

The chief items of treatment are:—

(1) Mechanical fixation of the spinal column.

(2) Adjustment of the mechanical apparatus, in accordance with the progress towards resolution.

(3) General rest of the patient.

(4) Modification of the bodily movements in accordance with the severity of the case.

(5) Nursing.

(6) Clothing.

(7) Food and medicine.

(8) Treatment of complications.

The chief symptoms which require special reference as regards treatment are:—

(*a*) Pain.

(*b*) Paralysis.

(*c*) Abscess.

1.—Mechanical Fixation of the Spinal Column.

Efficient fixation of the spine can only be accomplished by means of a mechanical apparatus.

Recumbency in bed alone is a very ineffectual method of affording rest to the spine.

Every movement of the head, of the arms, of the legs, twisting in bed, attention to the functions of the body, all

necessitate disturbance of the spine. Of course the patient can be strapped down tightly to the bedstead, so that a greater degree of fixation is attained, thus converting the bedstead into a splint; but such a method is far more irksome to the patient, and far less efficacious than the use of a properly constructed apparatus. In the case of young children, it is certainly, not infrequently, necessary to fasten the patient down to the bed; but even in such cases, we cannot dispense with the splint, for fixing and supporting the spine effectually. The effect of treatment by recumbency alone is so well expressed by my friends, Mr. Robert Jones and Dr. Ridlon, that I cannot do better than quote their remarks.

"This method of treatment, in its effective application, is so exacting to the patient, as to be well nigh impossible. It calls for the most careful nursing, and hence, is totally unsuited for the poorer population. It requires that the bed should be flat, smooth, firm, and without a pillow, and the patient so secured by straps that he cannot sit up, twist or turn. Thus, pass a strap of webbing or strong canvas bandage, across the bed, beneath the patient's shoulders, and fasten it to the bed-frame, on either side; upon this strap are strung two loops, through which the patients arms pass, and these are connected, the one with the other, by a strap across the chest. The pelvis is secured by a broad belt around it, from the sides of which straps pass to the sides of the bed-frame, and are there fastened.

"The patient must not be once allowed to sit up for food, for the use of the bed-pan, or for any other purpose; nor must he be taken from bed for bathing, for changing of sheets, or clothing, or for the turning of the mattress, if the best effects of recumbency are to be assured. To fail in strictly following these directions may cause the breaking up of the new bone formation about the carious vertebræ, a return or increase of the deformity, or may prolong the paraplegia, if present, and perhaps render it incurable. It will be readily seen that, although the surgeon is saved labour, it is very difficult to carry out this treatment for any considerable time; in fact, practically impossible to carry it to a successful result in any but an exceptional case. 'So-called' treatment by recumbency often means that the patient lies in bed when he chooses, sits up when he pleases, or gets up and walks when

he can. Under such conditions, it is not surprising that the deformity increases, that abscesses are frequent, and the duration of the disease prolonged."

I have elsewhere, and upon many occasions, explained the method by which I am in the habit of producing fixation of the spine, but there are a great many matters of detail which I have not hitherto published, and which I propose now to describe. To fix thoroughly the diseased part of the spine, it is necessary to control the column, as far as possible *above* and *below* the seat of inflammation. When the disease exists below the third or fourth dorsal vertebra, the spine may be supported sufficiently by an apparatus which extends from the extremity of the sacrum below, to the level of the shoulders above; but if the disease is above this part, it is generally and almost always necessary to continue the apparatus to the head. I say "generally and almost always," because absolute decision with regard to this point depends upon the case. In very acute cases, the necessity for fixation being greater, it will be more desirable to use the head piece, than in sub-acute and more chronic cases.

In some instances, even when the disease is in the upper three dorsal vertebræ (and especially in adults), the apparatus without the head piece may suffice, but in every case the instrument should extend to the level of the shoulders.

Principles of application.—To determine the principles upon which the apparatus should be applied, it is necessary to consider the objects to be attained in a typical case of caries.

In fig. 52, we see a side view of such a case. The disease is centred about the tenth dorsal vertebra, and probably extends upwards and downwards to the extent of a few of the adjacent vertebræ. The weight of the body above the disease is bending the spine forwards, increasing the pressure upon the anterior part of the bodies of the vertebræ, that is, upon the part where the disease is chiefly situated. The spine below the angle is curved forwards, producing, by its incurvation still greater pressure upon the diseased parts. This patient would probably support herself by resting her hands upon the seat, and so keep her head and upper part of her body more erect; but I have

placed her in this posture to show the position which the spine assumes when it is not being thus supported. To give this patient comfort, one hand should be placed upon the angle of deformity, covering as much of the back as possible, and pressing firmly, but gently, in the direction shown by the arrow A, and the other hand and arm placed across the chest, supporting the shoulders very gently backwards in the direction shown by the arrow B. If the patient is in much pain this support, carefully applied, will be found very agreeable.

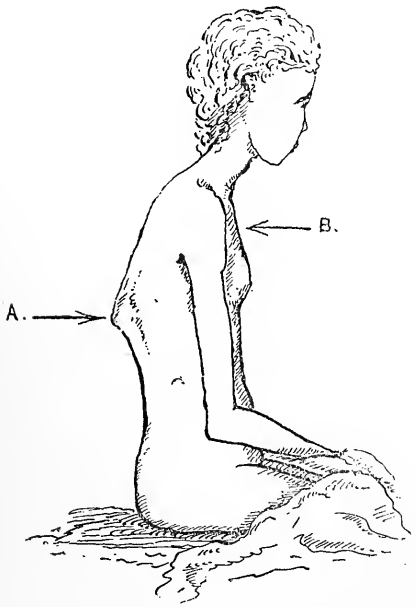


FIG. 52.

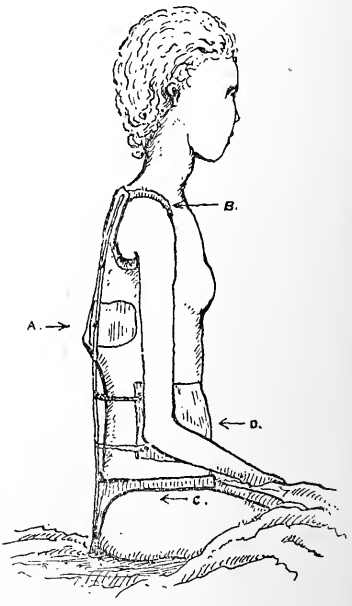


FIG. 53.

If, while the patient is in this position, the hand supporting the front of the body, be changed to the lower part of the sternum, just above the region of the stomach, the sense of comfort will be much decreased, or entirely removed. The first kind of support represents that which is brought about by the plan I recommend, and the latter is the kind of support which is produced by an ordinary felt or plaster jacket.

In supporting the shoulders backwards, the less we press upon the chest the better, and in applying the apparatus, it is

desirable to leave the chest absolutely free from pressure, depending entirely upon the shoulders for fixation. Of course this support with the hands is very incomplete, and does not affect the lower part of the trunk, so that in many cases it will not quite answer the purpose of testing the advantages of the principles of support here advocated. These principles of support can, *more or less*, be carried out by various apparatus. Dr. Taylor, of New York, aims at this kind of support, and M. Bonnet, of Lyons, and the late Mr. Thomas, of Liverpool, used splints made of leather, which were also applied upon somewhat the same principle, but by far the most manageable instrument is that invented by my colleague, at the City Orthopædic Hospital, Mr. Chance. This splint I have now used for many years with uniform success, and although I have introduced modifications in its construction, yet the principle in all parts is maintained. I call this apparatus the "Adaptable Metal Splint."

The Adaptable Metal Splint. — Soft shoulder straps, placed round each shoulder, are drawn back and attached to a pad behind the shoulders. Light steel plates padded are adapted to the spine at the side of the angle, a space being allowed for the spinous processes to project between (fig. 53). Two steel bars extend from the pad between the shoulders, upon each side of the spinous processes, to the level of the seat, where they are attached to a pelvic belt, the side plates also being attached to them. The pelvic belt should be firm at the back, so that by resting on the seat, it will support the whole body from that point upwards. (See figs. 53 and 54.)

If this formed the whole of the apparatus, much support would be given, but there would be a defective point. The vertebræ below the angle of the disease would still tend to curve forwards, as already explained, and it is necessary to counteract this tendency. For this purpose an abdominal belt, as shown in fig. 53, is used. We now have the spine firmly supported and fixed. The padded plates, at the sides of the angle of disease, support that part in a forward direction (arrow A). The shoulder straps fix the upper part of the spine backwards (arrow B). The pelvic belt retains the lower part of the instrument towards or in contact with the sacrum (arrow C), and the abdominal belt supports, through the abdomen, the part of the spine below the angle, backwards (arrow D).

Removal of any one of these points of support would diminish, more or less, or entirely take away the good effect of the apparatus.

If the shoulder-straps were undone the upper part of the body would fall forwards, and the same would happen if the pelvic belt were unbuckled. The removal of the abdominal belt would not produce so immediate an effect, but it would very much lessen the benefits of the apparatus.

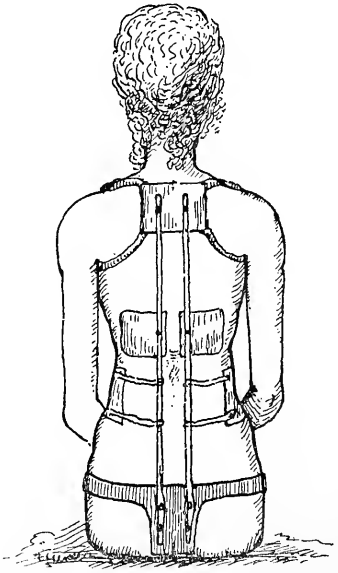


FIG. 54.
Posterior view of the "adaptable metal splint."

If the surgeon controls, as he should do, the construction of the instrument, and understands all its component parts, he will frequently be modifying his apparatus to suit the peculiarities of individual cases. Every part of it should be amenable to the surgeon's alterations, and I attach much importance to the exact strength of the bars. These are so tempered that by means of wrenches they can be bent into any position, and yet are sufficiently strong to resist the effect of the weight of the patient. One of the most important modifications which I have introduced is the separate attachment of the bars to the pelvic belt. Thus constructed, the in-

strument when once applied to a diseased spine, can be moulded with wrenches to the exact position necessary, and this position can be modified from time to time without taking away the support from the body. If it be necessary to change the bars, or one of the bars, or to renew or change any single part of the instrument, it can be done without interfering with the progress of the case. In an acute case of caries it is a very serious matter to have to remove the instrument, even for a few hours; in fact, generally it is very unwise to remove it even for a few moments. We have an immense advantage in being able to change any separate part in the manner described.

(A description of the head-piece for disease in the upper part of the spinal column is given below.)

It will be seen that the instrument should act by supporting the spine from before backwards and from behind forwards, and the only upward action should be that produced when the patient is sitting, and allowing the lowest part of the instrument to rest upon the seat. Its action should be quite different from that of instruments which are built up upon the pelvis with crutches under the arms.

The objection to these latter instruments is, first, the difficulty of taking a sufficiently firm basis from the pelvis, it being injudicious or impossible to apply them with sufficient tightness for this purpose; second, that, supposing this basis could be obtained, it would then be found impossible to apply the crutches so as to fix the upper part of the spine as thoroughly as it can be fixed by means of the "adaptable metal splint," the latter acting from before backwards; third, that they press upon the front of the thorax.

In considering the principles of support, we must not forget that the disease is situated in the *bodies* of the vertebræ, that is, the front part of the spinal column, and that the posterior part of the column is in almost every instance free from disease, or even in the worst cases is much less affected than the *bodies*. Therefore the backward and forward pressure has a more thorough effect in steadying and fixing the spine than the upward support of crutches.

By the method advocated we can relieve the diseased parts from excess of pressure more effectually than by attempts to

prop up the arms; and, moreover, such relief can be applied with great accuracy and delicacy. If we realise the serious nature of the disease; if we consider that the bones which should protect the spinal cord are partly or entirely dissolved away, sometimes leaving the cord exposed, and that the products of inflammation approach or press on, or involve the cord itself, we shall recognise the importance of possessing the most accurate means of controlling, adjusting and re-adjusting the position of the spine. Jackets of any kind, whether plaster of Paris, felt, or any other material, are very inefficient as supports. They do not take their points of resistance sufficiently high or sufficiently low in the back. The point of backward pressure to support the upper part of the body is too low, and acts against the front of the chest, pressing on

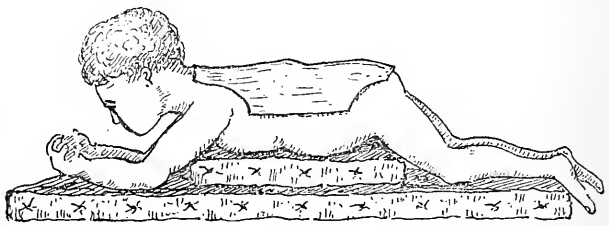


Fig. 55.

the lower part of the sternum and upon the ribs. This position of pressure is not efficient in fixing the spine, nor is it desirable to press upon the walls of the thorax in patients who are liable to be embarrassed, or are already embarrassed in their breathing. The plan of supporting the shoulders backwards, which I advocate, tends upon the other hand to expand the thorax, and to facilitate the respiration.

In discussing this matter with surgeons living in the country, they have urged that however advantageous the use of the apparatus as above described may be, yet that it is impossible for them to carry out such a method, removed as they are from the opportunity of having such an apparatus made, and also if they could obtain the instrument, they might experience difficulty in making the adjustments.

This objection is undoubtedly reasonable, and I will now describe a method of carrying out the principles which I

advocate, in a manner which can be effected anywhere. It is, I think, the best that can be done under the circumstances.

The patient being placed in the prone position, with the legs sloping downwards, at an angle of about 30°, or in other words lying on an angle of 150°, and the patient feeling perfectly comfortable and at rest; a piece of stout gutta-percha or leather is to be moulded to the back (see fig. 55), care being taken not to press too much upon the spinous processes of the diseased vertebræ. This splint should subsequently be lined with some soft material, and strengthened by having two bars of hoop iron, or sheet iron rivetted on from above downwards, on each side of the position of the spinous processes.

A loop should be attached to the centre at the top, or a large hook may be placed in that position, so as to retain a figure of 8 bandage passed round the arms, or shoulder straps may be attached. The lower part of the splint is to be fixed by a roller bandage round the abdomen, the thorax being left perfectly free. The addition of a firm pelvic band makes the support more efficacious. For children under about 2 years of age, this plan will generally act quite as efficiently as the instrument above described, and it will also do fairly well for older patients, but of course it does not allow of very accurate re-adjustment.

Fixation of the Head and Neck.

There is probably no part of the body the movements of which are so difficult to thoroughly and effectually control as the neck. There have been a great variety of apparatus devised for this purpose.

I would, in the first place, remark that it is impossible to control this part of the spine by apparatus unless they take a basis from the whole length of the back of the patient. The attachment of the arms to the spine is so unstable, that the shoulders alone do not form a sufficient basis of support, or in other words, the patient cannot keep the shoulders sufficiently in one position in relation to the spine.

Apparatus supported on the shoulders may grasp the head very firmly, but will allow of a moderately free movement of the neck. When shown in an illustration, such instruments

may look very attractive, but in practice they are very inferior to those which control the whole spine. Whatever instrument is used to fix the spine, and I should advise that which I have already described for the dorsal and lumbar vertebræ, the head should be attached to this in such a manner that it can be adjusted in any direction, fixed there, and be readily altered into other position as required. The ordinary jury-mast, passing in an arch above the head, is a very ineffective machine. It is often made to project far backwards so that the patient is unable to lie comfortably, if at all, upon the

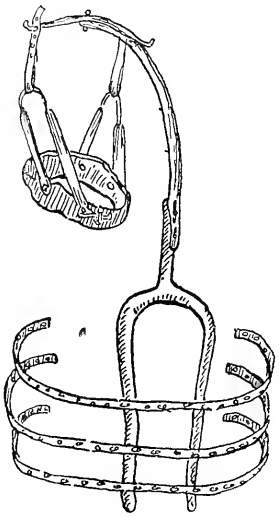


Fig. 56.
Jury-mast, after Sayer.

back. The object of this kind of head support is to fix the head by extension upwards, and it is endeavoured to attain this object by means of a support from the lower jaw. This plan is, to say the least, uncomfortable and irksome to the patient. To be at all effective it must be so tight that it produces considerable pressure, and interferes with the movement of the jaw. Every movement of the lower jaw will disturb the whole head, and if the disease is situated in the first two cervical vertebræ, this movement will very seriously disturb that part.

Naturally the weight of the head is always borne forwards upon the trunk, and the head is kept upright chiefly by action of the muscles at the back of the neck.

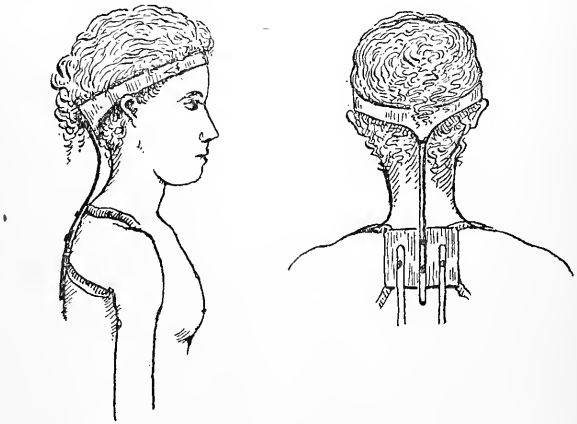
In an illness of any kind where the head feels heavy and oppressed, a patient will derive comfort from support applied anteriorly, and it is well known that the most comfortable way of supporting a sick person's head is by a hand supporting the forehead. A child suffering from Caries or other affection of the neck will frequently place the elbows upon a table, and allow the forehead to rest upon the hands. We find in practice that in using a fixation apparatus this kind of support is more comfortable than support beneath the jaw.

FIGS. 57 and 58.—Jury-mast applied, after Sayer.

Extension in a longitudinal direction, that, is by a process of hanging, is neither so effectual, nor agreeable to the patient as support from before backwards. The principles which I wish to advocate can be attained as follows:—

The head is grasped by a band, which encircles the cranium from the forehead to the occiput in the position of the brim of a hat which is pushed well on to the head. The front part of this band is flexible, the posterior half is firm, being made of metal covered with some soft material. To the posterior part of this band—that is at the central point of the occiput—a metal stem is attached, which can be bent by means of wrenches into the desired shape. This passes downwards, and is attached to the upper part of the dorsal support. Alterations in the exact position of this vertical bar may be made either before or after the lower part of it is fixed, and as

a rule these alterations can be made with great advantage while the instrument is being worn by the patient, and without removing it. In acute and very advanced cases, where very slight movements give great pain, and where we may do serious mischief unless great gentleness is observed, this mode of adjustment of the bar is too rough, and it is necessary to have rack joints for the purpose. These rack joints are to be made at the place where the vertical bar is attached to the head-piece, and where this bar approaches the dorsal support. The upper joints at the upper part of the neck permit the surgeon (1) to move the head from side to side; (2) to rotate the head; (3) to move it backwards and forwards. In all these cases the neck remains in one position. The rack joints at the lower part of the neck allow us (1) to move the head and neck together forwards and backwards; and (2) to move them from side to side.



FIGS. 59 and 60.—The head support recommended.

By one or other of these movements, or by a combination of two or more of them, any position of the head may be arranged, and such accuracy of adjustment is very necessary in cases of acute caries of the cervical vertebræ. An almost imperceptible adjustment will make a difference between pain and comfort.

When the disease is situated below the third cervical vertebra, rotation of the head, which occurs chiefly at the axis, may be allowed to take place freely, and then the joint,

between the head band and its upright bar may be converted into a free pivot-joint.

The vertical bar should be so arranged as to allow adjustment upwards and downwards. The simplest manner in which this can be done is by means of a longitudinal slot passing over a screw fixed to the dorsal support, and made firm in the desired position with a nut. The band which surrounds the head may be varied in shape, and it is generally advisable to have the posterior part wider than the band over the forehead; two inches deep at the occiput generally answers the purpose, and it should be curved from above downwards to fit the head. The band over the forehead should be from an inch to an inch and a quarter wide, and soft leather is the most agreeable substance for the head to rest against.

The part of this band which is flexible should be attached by buckling upon one side to the firm part. Sometimes it is well that this head-piece should extend downwards to grasp the mastoid processes.

By means of this fixation apparatus a thorough control of the parts is obtained, but there is no apparatus in orthopædic surgery which requires more care, perseverance, and accuracy in adjustment than an instrument for controlling the head and neck.

Recumbency and Extension.—This plan of treatment involves rest in bed. The head of the patient is extended towards the head of the bed by means of a sling. This is attached to the patient's head, and from it a cord extends to the end of the bed and passes over a pulley and a small weight is suspended (from half-a-pound to two or three pounds). The feet are attached by bandages and cords to the foot of the bed.

I do not enter into a detailed description of this treatment, because I believe it is far inferior to the local fixation by a properly-adjusted splint as above described.

Collars.—Although I have stated that apparatus applied to the neck alone are not thoroughly effective, yet such appliances may sometimes be found useful.

When the cervical caries is not very acute, or when we have to keep the patient recumbent for a time, a well-adjusted collar may be beneficial, used, perhaps, temporarily. In such circumstances Dr. Fleming's collar is a good one. (Figs. 61 and 62).

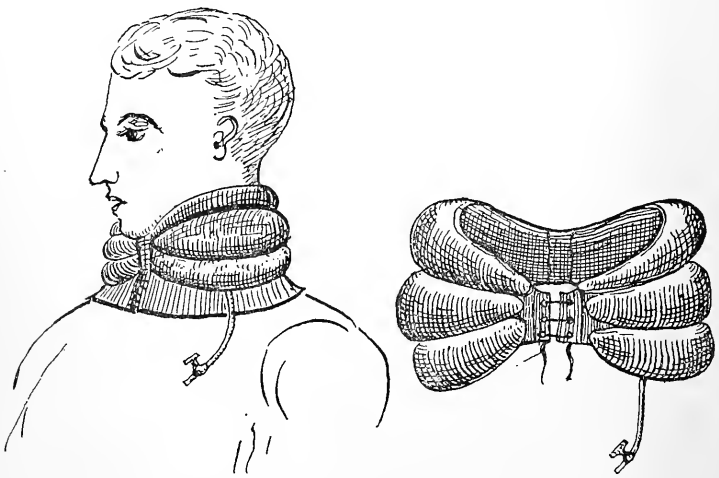
The collar consists of two sets of three fusiform india-

rubber bags, connected by a narrow flexible but non-elastic material, and having at the free ends flaps by which they can be laced together. The bags are to be inflated with air.

Dr. Fleming's plan consisted in applying plastic felt round the neck like a wide turned-down collar as shown in the diagram, the lowest bag bearing upon the collar.

A neck support acting on the same principle as the above was described in the *British Medical Journal*, October 31, 1885, by Mr. Henry Clark, surgeon to the Glasgow Royal Hospital.

Disease in the Lumbar Region.—The apparatus as already described does not control the lumbar region so perfectly as it does the dorsal, and especially the mid-dorsal, but it is sufficiently effective for the majority of cases.



FIGS. 61 and 62. Dr. Fleming's Collar.

It is advisable to prevent much movement of the legs, and the patient should especially avoid sitting on a low seat, as this posture necessarily causes the lumbar region to project backwards. Walking up and down stairs, and all actions which flex the thighs are harmful. Action of the psoas muscles is particularly to be avoided, as, from their attachment to the diseased vertebræ, their use may do harm.

In severe cases it is necessary to extend the apparatus to

the thighs, as in hip-joint disease. Complete rest on a prone couch helps in keeping the lumbar spine at rest, and then extension of the apparatus to the thighs is not always necessary.

When the "adaptable metal splint" is not obtainable, Thomas's splint for double hip disease is a very useful one, but the surgeon must be very careful in his adjustments of this rather cumbrous apparatus, as, if he tries to use the heavy wrenches while the instrument is *in situ* he will find it difficult to make his alterations with sufficient gentleness, but he may have the splint made with light, carefully-tempered steel bars, similar to those used in the "adaptable metal splint." These he can manipulate with very light wrenches, and make his adjustments and re-adjustments with great nicety.

If Thomas's double hip splint be used, some pads should intervene between the bars and the diseased part of the back. A piece of gutta-percha moulded on the part, and afterwards

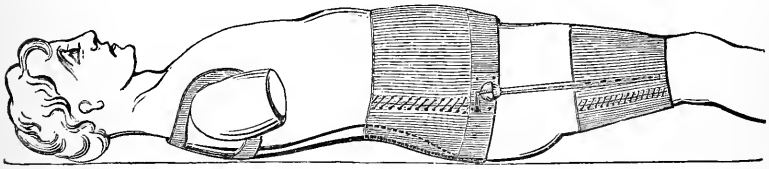


FIG. 63.
The back splint extended to the thighs.

lined with some soft material will answer very well. Although I have mentioned this appliance, I do not think it is to be compared in efficiency to the "adaptable metal splint" with extension to the thighs. The latter consists in the apparatus as already described, with troughs for the thighs which are connected with the pelvic belt by steel rods which can either be adapted by means of wrenches, or made with rack joints.

The rack joints are only necessary in extremely acute cases.

2. ADJUSTMENT OF THE MECHANICAL APPARATUS IN ACCORDANCE WITH THE PROGRESS TOWARDS RESOLUTION.

I have already stated that the surgeon should be able to bend and mould his supporting apparatus without removing it from the patient, and I should add that this adjustment is a

matter of the greatest importance. The surgeon who expects to meet the requirements of the case without a great deal of trouble, will probably meet with disappointment. Plaster and other jackets are, in comparison, very simple to use, but, on the other hand, they fail to provide the same degree of rest and support, and they cannot be so accurately adapted as the "adaptable metal splint." It must be clearly understood by the surgeon who deals with these cases, and by the patients, that if a good result is to be attained, no care must be spared to adjust the instrument into an effective position, not only on the first occasion of applying it, but upon as many other occasions as may be necessary. It must be borne in mind that every case of caries of the vertebræ in which the health of the patient is not absolutely undermined, either by that or any other disease, is not only curable, but curable without any increase in the deformity.

Many a patient has been said to be cured by a plaster of Paris jacket, but it will be found that in such instances, where resolution has really taken place, it has generally occurred at the expense of a considerable amount of deformity. I would even go further and say that, given an angle of any considerable degree produced by caries, there should be in the course of time an improvement in the position of the whole spine, not necessarily by a straightening out of the angle itself, but by the accommodation of the vertebræ above and below the seat of disease.

With regard to the question of stretching out the diseased part, I may say that I have never aimed at such an effect; I have only extended the spine to a degree which was absolutely comfortable to the patient, always with the object of relieving pain as well as of curing the disease. But I do not think that it is so certain as some surgeons assert, that it is impossible or injudicious to separate slightly the diseased bones from one another.

A case recorded below, No. 1, shows conclusively that a great space may exist between the diseased bones, and yet may be healed up by new bony growth.

In view, however, of the good results that can be obtained by treatment without any attempt at forced extension, I am not inclined to give the latter a trial until some greater reason for doing so occurs than simply the improvement in appearance of the patient.

I meant to attempt to describe the details of adjustment during the progress of resolution, but have found it quite impossible to do so. These details are matters of experience, and every surgeon who treats a case must learn them for himself. The principles upon which the apparatus is constructed should be acted upon, and I would strongly advise that this be done in the surgeon's own way, rather than that he should use an apparatus with which he is imperfectly acquainted.

In making alterations in the instrument I am guided very greatly by the feelings of the patient, but not necessarily by his *suggestions* as to the required alteration. These alterations become more difficult in those cases where there is an absence of pain, and, as I have already stated, such instances are not so rare as it is often supposed. I have seen diseased spines in every variety of deformity which have progressed without any pain. In some instances, abscesses have formed without the patient suffering in the least. Some of these cases are recorded below.

It is of very great importance that the adjustments should be made without removing the supporting apparatus from the patient's back, both on account of accuracy and, in acute cases because even momentary removal is dangerous.

3. General Rest of the Patient's Body.

Although rest of the spine is allowed by all surgeons to be the most important factor in the treatment of spinal caries, it is very rarely that rest is thoroughly carried out. I have already remarked that recumbency in bed alone does not afford sufficient rest, but that a well-adjusted apparatus (such as I have described), is the most important means of attaining this end. However, in an acute case even this means is not sufficient. In acute disease we must bring to bear every possible method of saving the spine from movement, and I will now describe the details which I believe are desirable under such circumstances. Absolute recumbency is to be insisted upon. A very young child may be placed on a flat bed in any position in which he is comfortable, lying either upon the back, or upon one side, or in the prone position. If the child is two years of age or older, the prone position on a properly constructed prone couch is by far the best posture he can be placed in.

For the use of the prone couch, success or failure depends entirely upon the manner in which the couch is made and used.

As usually made in the present day it is of an entirely different shape from that originally devised by Verrall, and perpetuated by my colleague, Mr. E. J. Chance.

I have hardly ever had a patient with spinal caries in the dorsal region, who has not expressed delight with the prone couch, when it has been necessary to use one. Many children will, of their own accord, assume the prone position by getting

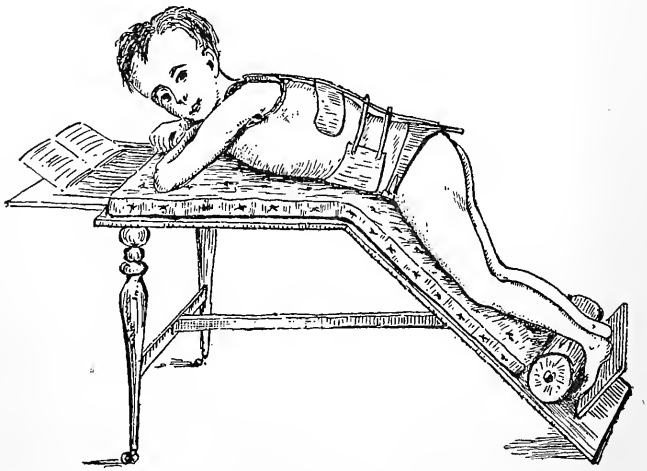


FIG. 64.

In this couch the angle is rather too acute; it is 130°, whereas it should be about 150°. This latter angle will produce about 160° of flexion of the hips, because the patient generally raises the chest higher than the abdomen.

on their knees and elbows in their bed, and one child (Case No. 1) had remained in that position for months, and refused most vigorously to be placed in any other posture. In the prone position the patient should rest upon the abdomen, and his chest be only very gently supported with a cushion. Not only will children assume the prone position of their own accord, but the same inclination has been observed in animals.

Swan records a case of caries in a monkey, a Scamang (Hylobatis Syndactylus). "This animal was first noticed to be unwell during a cruise to Norway in the yacht of its owner.

He constantly assumed the prone position when lying, and when walking grasped his lower extremities with the paws of his upper limbs in a manner painful, though ludicrous to behold, and in faithful imitation of a child similarly affected. When killed, the bodies of the fifth, sixth, and seventh dorsal vertebræ were found to be almost obliterated, a collection of cheesy pus occupying the situation."

Fig. No. 64 shows a patient resting upon a prone couch. The feet are well supported by the foot board, in such a position that the hip joints are above the angle of the couch. The patient rests upon his elbows or with his arms upon a pillow, and his head upon his arms. If the caries is situated higher in the spine (or in fact in any case), he can have a head rest to support his forehead. On this couch he should remain

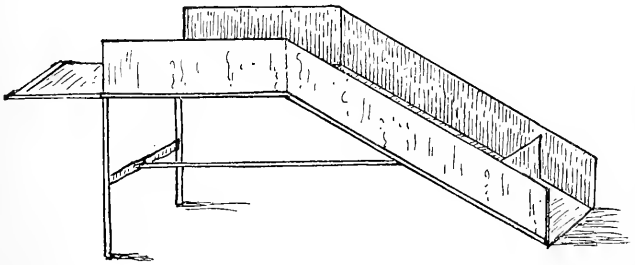


FIG. 65.

Simple form of prone couch used at the City Orthopædic Hospital, having boards at the sides to prevent a young child from falling off. Devised by my colleague, Mr. E. J. Chance.

as much as possible, but discretion must be used as to movements. If the disease is very severe, it may be best, and most comfortable to the patient for him to remain day and night upon his couch, but it is often convenient to let the couch be used only in the day, and the patient placed carefully upon a bed at night.

4. MODIFICATIONS OF THE BODILY MOVEMENTS IN ACCORDANCE WITH THE SEVERITY OF THE CASE.

The foregoing directions for rest of the body may be very considerably modified in a large number of cases. The child

may be walking about and suffering a moderate amount of pain, and yet be affected with acute caries, and the deformity may be rapidly increasing.

Such a case, when the supporting apparatus is applied, may be immediately relieved from all pain and discomfort, and resolution may begin to take place immediately and continue satisfactorily, without the patient being kept in a recumbent position. Here again, experience teaches us to what extent we may allow movements to take place, but we must always bear in mind that it is far better to reduce the movements too much than to allow the least excess. It may be impossible in such cases to determine, upon first seeing a patient, the exact amount of rest required. We must carefully watch the result of our treatment, and be prepared to limit the movements in accordance with the progress.

In advising the use of supporting apparatus, it has often been urged in their favour, that the patient is by their use enabled to obtain the benefits of fresh air and exercise, which are said to tend materially towards recovery.

I cannot agree with this opinion. Fresh air every patient should have, however much he is kept at rest; but exercise may be very harmful, and should never be allowed if it produces any discomfort or other signs of mischief.

Exercise is of no help towards recovery. It is, of course, desirable not to impose all the trouble and expense of absolute recumbency unless it is necessary, but in no case is exercise to be looked upon as beneficial.

Children may be thin, anæmic, and showing other signs of deficient general health while going about, and will quickly gain flesh, colour, and vitality when relegated to absolute recumbency, and it is only by keeping this fact in view that success in treatment can be insured.

Even when the patient can be safely allowed to walk about, it is desirable to insist upon very great restriction. His movements must be made carefully; he must avoid sudden exertion, especially twisting his body. He must be taught to move with his spine held as rigidly as possible, to get up from a chair or sit down with the utmost deliberation, to walk gently, and especially to avoid tripping. In all cases, and especially if the disease is situated high in the spine (above the sixth dorsal vertebra), he must be very sparing in the use of his arms, never

carrying or lifting anything at all heavy, and never using much exertion with them. No patient suffering from spinal caries ought to attempt to put on his own boots, and even drawing on socks or stockings is decidedly harmful.

5. Nursing.

We cannot expect a nurse to understand the sort of care required in handling a patient with caries of the spine without special instruction. She must be made to understand something of the nature of the case; that the diseased part is in an extremely weak condition, and that if much strain is put upon it, very serious injury will result.

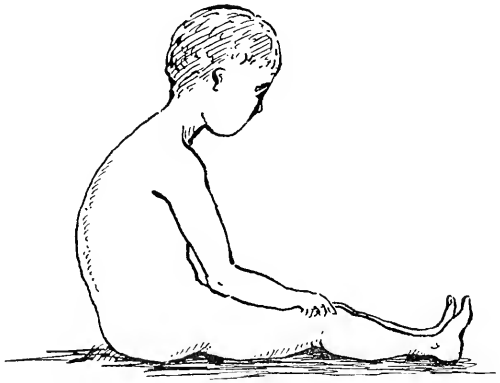


Fig. 66.

Position of a healthy child's back in sitting on a flat surface with the legs extended.

In carrying or lifting a patient the whole spine is to be evenly supported, and this can only be thoroughly accomplished by lifting the patient on the supporting apparatus as described below. The nurse must also understand that separate movements of the arms and legs will influence the spine, and that even the head must not be allowed to be unsupported when the child is horizontal.

If the thighs are supported slightly flexed upon the body, the legs may hang at a right angle to them, but the thighs must not be bent up upon the abdomen.

When the patient sits up (supposing he is well enough to do

so) it is important that the knees should be bent, as, if they are extended, the spine is necessarily bowed backwards.

Figs. 66 and 67 show this.

Of course the instrument will prevent the back bending posteriorly very much, but still the strain will be severe and will do harm.

All twisting of the body is to be very carefully avoided. When recumbent the legs and hips must not be turned laterally without the body being turned also.

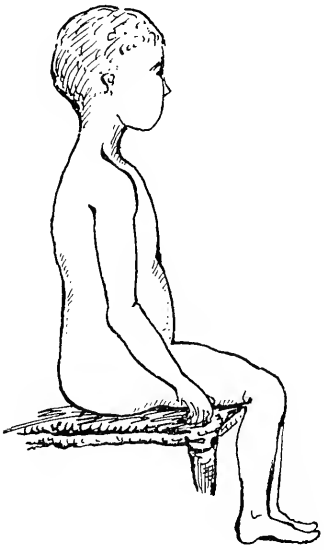


FIG. 67

Position of a healthy child's back in sitting up with the legs bent.

Carrying a Patient.—Great care is necessary to carry the patient safely. The arms of the nurse should support both extremities of the instrument, or the right arm may take all the instrument and the left the thighs, but it is well that the ends of the fingers of the left hand should just grasp the lower end of the splint. One arm should be placed beneath the patient's shoulders, the head resting against the upper arm, the other hand supporting the back of the pelvic belt, and this arm should support the thighs. By this means the spine may be prevented almost absolutely from movement.

It is of the utmost importance that the nurse should observe the greatest tenderness and care in moving the patient. The slightest jolt should be guarded against, and every care taken to avoid producing any pain.

Washing the Body and Attention to the Functions.—Unless care be taken in washing the body, and attending to the functions, our best efforts may be fruitless, and the symptoms remain unsubdued. In very acute cases where the bodies of one or more of the vertebræ may be entirely dissolved away, where the child is possibly powerless in his legs, and where there is incontinence of urine and difficulty with the bowels, harm may be done in a few minutes which may upset all the good which has been secured by a month's treatment.

General Washing of the Patient should be carried out without disturbing the spine, and if the surgeon is not sure about the carefulness of the nurse, it will be well that the washing be considerably limited rather than subject the patient to the risk of injury of the diseased part. Powdering the body thoroughly with prepared Fuller's earth will take the place of washing to a great extent, but still a certain amount of ablution is absolutely necessary.

To wash the patient, we will assume that he is in the prone position, lying thoroughly supported on his couch or mattress, his arms resting on a pillow, and his head on his arms. Then the instrument is to be unbuckled. The straps of both arms, the straps on one side of the abdomen, and the strap of the pelvic belt being unfastened, the instrument can be lifted sideways as if it were a lid, but not in any other way removed. The back of the patient is then to be washed carefully, dried, and the instrument buckled on again. Every buckle having been carefully fastened, the patient is then to be lifted up, and placed on his back on a flat bed or mattress, taking care that he is comfortably supported. Then the straps should be again unbuckled, and the front of the body exposed and washed, and the straps again fastened.

The functions of the body are to be carefully attended to, and if the nurse does not manage without disturbing the patient unduly, the surgeon must tell her what to do. It is not difficult for these matters to be attended to on the prone couch, but it is sometimes preferred to attend to the bowels while the patient is resting on his back in bed.

For that purpose an ordinary small bed-pan is available, and it is a good plan to let the patient lie on two mattresses separated slightly in such a manner that the bed-pan can be passed between the two so that the patient need not be raised up while it is being used.

6. Clothing.

Warmth is to be maintained, and especial care is required, with the parts affected, in cases of paralysis.

Putting on and taking off children's ordinary clothing is very liable to do harm by disturbing the position of the body. Every garment should be made upon the principle of a dressing-gown, *i.e.*, open down the front or back, or both, so that they can be put on and taken off without being passed over the head or legs of the patient. No part of the clothes should be tight, and the sleeves especially should be large. Flannel should predominate. As the treatment with the adaptable splint tends to develop the thorax, it necessitates more room in the clothes in front of the chest than has been required before the treatment commenced. This especially requires attention when the patient is getting about, as when constantly recumbent much looser garments are generally worn.

I have frequently found that clothes which were quite loose upon the chest before the treatment commenced are from one to three inches too tight soon after the application of the splint. It must be further borne in mind that as the chest is *continuing* to expand for months after treatment has commenced, the space provided must not only be loose at the onset, but be sufficient to allow for this further development.

7. Food and Medicine.

It is hardly necessary to state that plenty of good wholesome food should be given. Meat and other nitrogenous food should predominate.

Medicinal treatment must be based upon general principles, but most cases of caries are benefited by some easily digested preparation of lime and iron.

I prefer a neutral solution of lime, with a small amount of ammoniate of iron.

8. Treatment of Complications.

(*a*) **Pain**, as already stated, is not a certain indication of the severity of the disease. The pain may be very acute, or it may be entirely absent, and we meet with every degree of variation between these extremes.

The pain being caused by irritation of the nerves coming from the spinal cord, and this irritation being a consequence of the inflammation which exists, all treatment should be directed to reducing that inflammation. One of the first symptoms of the benefit of the fixation of the diseased parts is the subsidence of pain.

Upon the first application of the supporting apparatus we should be able to lessen, more or less, this symptom. Sometimes all pain will cease from the moment of putting on the splint and never recur. At other times the pain is either entirely subdued or very much reduced at the putting on of the apparatus, and begins to get bad again in a few days, when by readjustment of the splint it can again be relieved. Thus the pain may recur again and again, but decreasing all the time until perhaps in a fortnight all pain has been removed.

Recurrence of pain is a sign that alteration in the position of the splint is absolutely necessary in consequence of an alteration in the position of the diseased bones. These alterations in position of the bones are probably caused chiefly by absorption of the inflammatory products. As a consequence of the rest the spine falls into a different position from time to time, until it settles into one in which it remains while resolution takes place.

These recurrences of pain should be immediately attended to, and this can only be done with an instrument which can be accurately adjusted by the surgeon without being removed from the back. I avoid as much as possible the use of sedatives, for the reason that I look upon pain as an indication for re-adjustment, and because such re-adjustment very rapidly gives the patient ease. In applying an instrument for the first time the surgeon should persevere until he has succeeded in giving the patient relief, although in some cases it may be a very difficult result to attain.

During the progress of treatment pain may be caused by undue pressure of the instrument, and if this is not attended to the skin will soon become abraded. If a sore place is once allowed to occur, it is very difficult to get rid of, because however much the pressure be reduced it will be enough to keep up irritation and prevent the sore from healing.

However accurately adjustment may be made one day, the instrument may be rubbing somewhere a few days later, and if such is the case the surgeon should be summoned at once to relieve it. All the varieties of pain described under the head of SYMPTOMS are to be controlled by the treatment as above described.

(*b*) **Paralysis.**—What has been written above regarding the treatment of pain applies to a great extent to the treatment of paralysis. That is to say, paralysis being caused by pressure upon, or irritation of the spinal cord itself, or the nerves coming from the cord at the seat of the disease and as a consequence of that disease, so everything which tends towards resolution will conduce to the relief of the paralysis.

In all cases of caries of the spine in which the health is not thoroughly undermined, and in which, as I have already stated, a cure should be looked for, we may confidently expect relief from the paralysis. I have had no case of this kind which has not recovered from the paralysis.

I have known patients, paralysed entirely as regards motion in the lower extremities, including paralysis of the bladder and rectum, and even paralysis of sensation, existing for months and even years, to have perfectly recovered after careful treatment.

In paralysis care is especially necessary to prevent rubbing and irritation of the skin.

The depressed vitality of the parts paralysed, renders the skin very liable to such irritation. A water-bed is often an advantage. The skin should be kept dry and clean and as free as possible from contact with the excretions. The urine, which is generally a much greater trouble than the fæces, can be better carried away when the patient is on a prone couch than in any other position. A urinal will be found useful for this purpose, and a very simple one may be made with a rubber funnel attached to a long tube which can pass through a hole in the couch.

As a rule, however, the patient can be kept dry by using cloths or other absorbent material. It is only in severe and neglected cases that bed-sores occur.

Complete paralysis of sensation as well as motion is rare, and cases of caries do not present the difficulties which occur in many instances of paralysis from fracture of the spine, or disease of the spinal cord.

Counter irritation.—The use of moxas, setons, issues, and the actual cautery upon each side of the spine in the neighbourhood of the diseased bones, belongs chiefly to a past age. The pain and shock to a patient whose vitality is not of the best; the prevention, in consequence of the situation of the sores, of efficient fixation of the part; and the inefficiency of these remedies are sufficient to condemn them, as a rule. In cases, however, in which pain persists in the vertebræ, and especially in the spinous processes, notwithstanding careful treatment as above advocated, the use of counter irritation may be productive of benefit. However, a much less severe method of giving relief in such cases is *drilling* into the spinous processes. This operation will generally act most beneficially. This operation is described on page 109.

The Injection of a solution of carbolic acid (2 per cent.) into the body of a vertebra, or in its close proximity by means of Pravaz's syringe, as recommended by Hueter, is a remedy which is not without danger, as it is almost impossible to be sure that we shall not injure important adjacent structures.

I have not adopted this method, but I have injected a 1 in 40 solution of carbolic acid into the wound after drilling into the spinous processes, in the same manner that I have dealt with tuberculous inflammation of the joints by drilling into the bones in their neighbourhood.

CHAPTER V.

TREATMENT (OPERATIONS).

Laminectomy.—The safety with which operations can be performed under strict antiseptic precautions, has rendered the removal of the arches of one or more vertebræ a possible procedure in cases where pressure upon the spinal cord has given rise to symptoms which require immediate alleviation, or which stand in the way of progressive improvement of the patient towards recovery.

In all severe cases of caries of the spinal column, symptoms of pressure and local irritation are apt to arise, and the functions of the parts below the seat of disease are then more or less interfered with by interruption of their normal nerve supply, as already described.

Tubercular deposits in the membranes of the cord, abscesses in the immediate vicinity, inflammatory exudation, or in some cases displacement of the bones, or diseased portions of bone surrounding the spinal cord, may produce pressure upon or irritation of this nerve centre and give rise to more or less serious symptoms.

We are accustomed to see the results of this pressure disappear upon the careful application of the measures already described, which include fixation of the spine in a good position, and other treatment calculated to rest the parts in conjunction with general hygienic improvement, and therefore, it must not be too hastily assumed that because the patient is suffering from severe symptoms of interference with the spinal cord that the operation of laminectomy is necessarily indicated. (See CASES.)

The temptation to resort to an operation which is very likely to give immediately good results is very great, but we should consider in the first place the disadvantages which are involved.

I have already described the great value of the bony arches of the vertebræ, in the treatment of caries; how by supporting the trunk backwards, so that its weight is sustained by these arches (which are seldom themselves diseased) instead of by the inflamed and carious *bodies* of the vertebræ, rest is afforded to the latter parts. Now it must be obvious that if we remove one or more of the arches, we remove sound parts upon which we were relying for such valuable help. Certainly the articular processes are left, and these being seldom involved in the disease, serve to a great extent to sustain the body weight, also in many cases we may depend upon utilising in the same way the more posterior portions of the bodies of the vertebræ themselves, but these parts are very limited in extent, and therefore our efforts to fix the spine in a good position are considerably lessened.

Another drawback is the immediate effect of the operation. That it is comparatively free from danger *as an operation* is doubtless true, but the disturbance of the diseased parts, especially by the force necessary to cut through the bony laminæ is an element worth consideration, bearing in mind how desirable it is, in these cases, to avoid all shock and disturbance as antagonistic to that perfect rest which is so essential to effect a subsidence of the inflammatory process. True it is that bone may be re-formed, and in time the gap may be filled up with firm osseous structure, but this takes a considerable period, and it is always desirable, and sometimes a matter of grave importance not to increase the inflammatory process. *Immediate* rest is of the greatest importance. Another bad result which has followed this operation has been inflammation of the membranes of the cord, and even of the cord itself.

Notwithstanding these drawbacks to the operation, cases may occur in which such a procedure may be imperatively demanded, or at least may be the least of two evils, or may, perhaps, be the only remedy which seems possible to avert an otherwise unfavourable result.

It has been stated by surgeons who have had recourse to laminectomy that they have first tried the effect of other remedies, and have not operated until the treatment by rest alone has failed, and the patients have been getting worse. The previous treatment by rest has been carried out probably

by recumbency alone, or by means of plaster or felt jackets, or possibly of some other inefficient support, and so I would urge that the support has often not been perfect. This opinion is based upon my belief that the fixation and support afforded by the plan of treatment which I have advocated, is incomparably more effectual than that given by recumbency alone, or by jackets. Therefore we may consider that the reasons for resorting to the operation have not been in all such cases sufficient.

I perfectly agree with the dictum that *if*, notwithstanding all our efforts to cure by other means the patient is getting worse, and the symptoms of pressure and nerve irritation persist, then a resort to operation is called for, and it is only as regards the carrying out of the former methods that I would urge a different course.

Paraplegia persisting, notwithstanding the thorough rest of the spine *and the relief of all symptoms of pain and irritation by gradual adjustment of the supporting apparatus ;* or other symptoms of local mischief continuing, would denote pressure either by a displaced vertebra, or displaced piece of necrosed bone, or firm tuberculous material, or a circumscribed abscess, and under such circumstances the operation of laminectomy might be called for.

The Operation.—This consists in making a vertical incision in the median line over the spinous processes, separating the mass of muscles from each side of these processes, stripping back the periosteum, cutting away the spinous processes, cutting through the laminæ on each side, and removing the posterior portion of the vertebral arches. The membranes of the cord are then exposed and any deposit thereon removed, the cord can be drawn aside and the front part of the canal approached, and it is possible to relieve an abscess in the bodies of the vertebræ, or to remove carious or necrosed bone from this part. The filling up of the cavity thus created with glycerine and iodoform or other antiseptic, the insertion of a drainage tube, and the careful closing up of the wound completes the operation. The tube can be left in for 24 to 48 hours or longer, according to the indications which present themselves, and the further treatment of the wound should be conducted on ordinary antiseptic principles.

After the operation the supporting apparatus should be

immediately applied, as at this time the apparatus is more imperatively demanded even than before, because so much of the bony column which would have afforded considerable help towards supporting the part, has been removed.

The results of this operation have varied. The majority of patients operated upon have been immediately benefited, but there has been a tendency to relapse, and this points to failure in the supporting apparatus, a failure which may in some cases account for the supposed necessity of the operation in the first instance.

Wiring the vertebræ.—Uniting the spinous processes by means of stout wire after cutting down upon them by a vertical incision has been proposed, the object being to fix the bones together and to relieve the diseased parts from pressure. The objections to this plan of treatment are:—

1. The inefficiency of the support, as it does not control lateral motion, and it does not allow of the necessary adjustments in accordance with the progress of the case. Moreover, the great strain on the wire would cause either a breakage of the wire or severe injury to the spinous processes.

2. The local disturbance of a foreign body.

3. The fact that properly arranged mechanical support as described above is far more effective.[1]

Bone Drilling.—It is now some years since I first tried the effect of bone drilling in the neighbourhood of diseased joints with the view of relieving tension.

The remarkably good results which followed this operation in cases of chronic inflammation of hip, knee, and ankle led me to adopt the same procedure in cases of persistent pain in the spine, when unusual pressure upon one or more spinous processes produced distinct and severe pain. The result has been very satisfactory.

Fixation alone will generally relieve all pain in the spine in caries, but in some instances of this disease, notwithstanding general improvement, the local pain, greatly increased by pressure, has remained persistent, denoting, I have thought, that congestion or inflammation was present in the spinous processes.

---

[1] For operations performed, especially for abscess, see next page.

This pain is quite distinct from the deep-seated pain of caries of the bodies of the vertebræ. I have always found that perfect relief has been afforded by this operation, and as it is a practically safe one, I have not hesitated to carry it out whenever the symptoms have denoted its desirability.

In some few instances a puncture to the bone with a tenotomy knife, and incision of the periosteum, has had the desired effect, but generally it has been necessary to insert a fine drill about one-eighth of an inch in diameter, penetrating the bone until the cancellous tissue has been reached.

For two or three days subsequently a smarting sensation has generally been felt by the patient, after which all pain has ceased. When the pain has been very severe I have followed the operation by injecting a solution of carbolic acid (1 in 40), but I am not sure whether any extra beneficial effect has been thus produced.

That drilling into the spinous processes is effectual in subduing such pain, notwithstanding other treatment, is a fact which I have been convinced of by repeated trials, and although we know that caries only very rarely attacks these processes of bone, yet it seems probable that they may be frequently in a state of congestion sufficient to give the patient considerable discomfort, and it is obvious that the operation is capable of relieving such a condition by giving an exit to the excess of blood pressure.

Operation for Abscess.—Until quite recent years the opening of spinal abscesses was looked upon with great apprehension of evil results. The contamination of the contents by the air, or in other ways, frequently produced septic infection, and the patients rapidly succumbed to the blood poisoning thus produced. (Acute septic disease, or chronic septicæmia.)

If the patient escaped septic contamination, then it generally happened that prolonged suppuration occurred, whether the opening was made by the surgeon or by nature, and the patient became gradually exhausted from the constant drain upon his vitality or from the effect of waxy degeneration of the liver, kidneys and other organs. The advent of antiseptic surgery first led to endeavours to exclude the air by local applications to the external opening, but such precautions were very uncertain in their effects.

To avoid the dangers which were once thought inseparable

from the opening of these abscesses, aspiration was brought into use. A fine tubular needle being passed into the sac, as much as possible of the contents were removed, the needle withdrawn, and the opening carefully closed and allowed to heal up. This course is followed by some surgeons at the present day, but it cannot be recommended as satisfactory or desirable, except in the cases mentioned below.

In the first place, it is seldom that the contents are sufficiently fluid to pass through the tube of the needle, and even if a large quantity of matter be thus removed, it is very likely that some clots or pieces of carious bone will be left behind.

It has been stated that the injection of a few drachms of tincture of eucalyptus will after a few days have liquified the contents, but this can only apply to the solution of clots, and not to pieces of bone.

After aspiration the pus, with a few exceptions, gradually collects again, so that in the course of some weeks, or perhaps months, the operation has to be repeated.

Sometimes pus re-forms very rapidly, so that the aspiration has to be repeated in a few days, and so on again and again. In a few instances, after one or more aspirations the abscess has ceased to re-appear, and has apparently been cured, but such a result is very uncertain and unlikely to happen. However, in the case of some very large abscesses, where the contents are thought to be sufficiently fluid, the size of the abscess may be diminished by aspiration some time previous to a more thorough operation.

Pathology.—The most modern view of the pathology of a chronic abscess is that it is quite different from acute abscess, and that it is "a tuberculous tumour with a softened centre." Upon this "theory," or we may perhaps say "knowledge," modern treatment is based.

Evacuation, antiseptic dressing of the abscess walls and closure of the wound.—This plan of treatment consists in washing out the cavity with a weak solution of carbolic acid, or other antiseptic, after evacuation by a free opening; the injection of a 10 per cent. emulsion of iodoform in olive oil and glycerine, or iodoform in ether, and closure of the puncture. This plan has not, however, proved quite successful, as the walls of the sac remaining give rise to further secretion of purulent matter which has to find its way to the surface.

Entire removal of abscess.—Any chronic abscess (or collection of tuberculous material) that can be dissected out without being opened, can be thus most thoroughly eradicated; the wound made by operation is then closed up and heals by first intention. Doubtless this is by far the best plan of treatment where it can be carried out. In dealing with spinal abscess, however, it is very seldom indeed that such a course is practicable or advisable. An opportunity for operating in this way may, however, occur in those very exceptional cases in which the caries exists in the spinous processes, or in the arches of the vertebræ.

The depth and extent of a spinal abscess, its situation, often in close proximity to vital organs, and its connection with the bodies of the vertebræ make the excision of the whole abscess either impossible, or at least impracticable.

Scraping out the cavity.—The next best plan of dealing with chronic abscesses, and one which is more commonly applicable to spinal abscess, consists in removing as much of the walls of the cavity as possible, by cutting away with scissors, and by scraping with a Volkmann's spoon and freely flushing out the parts removed. After removing as much of the lining membrane as possible by these methods, dry rough sponges, attached to long holders, should be assiduously rubbed over every part of the abscess cavity, and this procedure should be continued until the walls are denuded of their lining membrane, and the cavity converted into the condition of a clean, aseptic wound. Although there may be free bleeding at first, this gradually ceases. Great care must be taken, when the abscess is situated deeply from the surface, to avoid injuring vital organs.

A post-pharyngeal abscess should be opened behind the sterno-mastoid muscle, and care taken in scraping not to penetrate into the pharynx. (See below.)

In deep situations, and especially if near a large vein, or the peritoneum, a coarse sponge may be used exclusively to remove the surface of the walls, and the Volkmann's spoon omitted. Dealing with long sinuses—and these especially occur in psoas abscess—a sponge on a probang is very useful. I have adapted the bristle throat probang for this purpose, the bristles being expanded after insertion of the probang, and the apparatus then withdrawn. During any of these opera-

tions and afterwards, the cavity should be thoroughly flushed out with a weak antiseptic fluid, such as 1 in 10,000 sublimate solution, the fluid in the cavity squeezed out as much as possible, and lastly, an injection made of one to two ounces of a 10 per cent. emulsion of iodoform in glycerine, with perhaps a small addition of sublimate solution and the external opening carefully stitched up.

If we have been able to thoroughly evacuate the cavity of its lining membrane, then immediate closure will probably be followed by a perfect cure; but it often happens that the removal of lining membrane is only partial, and then some collection of pus recurs, and necessitates either aspiration, or a simple incision and flushing with the antiseptic solution, followed by again reclosing the wound. This second interference will often be followed by a permanent cure.

Simple daily syringing with an antiseptic solution.—About fourteen years ago I began to adopt the antiseptic principle of treatment by opening the abscesses freely, and injecting the cavity with antiseptic fluids, and with such treatment I have never known any abscess to become contaminated.

I have freely opened all chronic abscesses, and have syringed out the cavities daily with a solution of carbolic acid (1 in 40) without producing anything but beneficial results.

Once only have I seen any symptoms of carbolic poisoning, and that consisted only in a slight smokiness of the urine, which ceased in a few hours after the substitution of another antiseptic.

More recently I have used a 1 in 60 solution of the acid, sometimes commencing by one injection of a much stronger solution (1 in 30). This treatment has been followed by excellent results, the cavities closing up perfectly in a few weeks and remaining permanently cured.

The evacuation of the lining membrane of these chronic abscesses, as above described, is undoubtedly a better plan of treatment, when it can be thoroughly carried out, but in cases where it is doubtful whether we can remove the whole of the lining membrane, it is a very good plan to follow our operation by daily irrigation without closing the wound, in place of the immediate closure.

There is another very important point for consideration in deciding whether to close the external opening at the time of

operation, or whether to continue daily injections and allow the cavity to heal up gradually. It is seldom that we can be sure that the seat of diseased bone is so far advanced towards recovery that no further *débris* sufficient to keep up the secretion of pus will come away, and therefore, however thorough our removal of the lining membrane may be, there will be a great likelihood of re-formation of the abscess. In many of the cases treated by immediate re-closure, the abscess has re-formed, and further operations have been necessary.

In very many of the cases in which no second interference was required, as well as in those where such a course was necessary, it is likely, or we may say probable, that a certain amount of re-formation has taken place at the seat of bone disease, and has eventually gone through the process of "drying up."

The antiseptic injection.—I believe that nothing is better than carbolic acid, and this view has lately had the support of Sir Joseph Lister, who, after years of experiment with a large number of substances, has returned to a great extent to that which he first advocated—carbolic acid. Corrosive sublimate 1 in 10,000 is also a safe and useful fluid. Eucalyptus oil is also good as a change of injection. For a final injection in cases in which it is thought judicious to close the opening, the iodoform emulsion in glycerine referred to above is probably better than iodoform in ether, a sloughing of tissue having followed the use of the latter in some instances.

Retro-pharyngeal abscess.—An abscess at the back of the throat may assume very considerable dimensions before it is detected. It may cause serious dyspnœa, and even necessitate laryngotomy. It may extend into the posterior mediastinum, as already mentioned. It may open spontaneously at any moment, and may enter the larynx, and produce fatal asphyxia. The latter result may occur even if it be opened surgically *in the throat*; moreover there is great liability to septic contamination of the contents. To obviate these dangers and inconveniences, the operation first suggested by Professor Chiene, of Edinburgh, is much to be preferred to an opening in the throat. A longitudinal incision about $1\frac{1}{2}$ inches in length is to be made at the posterior border of the sterno-mastoid muscle from a little below the apex of the mastoid process. The transverse processes of the vertebræ are then to

be defined, and it may be necessary to draw the sterno-mastoid forward for this purpose. The deeper opening may be made with a blunt instrument, such as a director or dressing forceps.

Fluctuation may be detected by one finger placed in the wound and another in the throat.

A certain amount of laryngitis and œdema of the glottis may be present, and tracheotomy has sometimes been necessary under such circumstances, to relieve the patient from asphyxia. After opening the abscess behind the sterno-mastoid, the general principles of treatment described above can be followed.

Sequestra of diseased bone.—It occasionally happens, although rarely, that a large piece of bone dies and becomes separated from the body of a vertebra, and remains as a foreign body at the seat of the disease. Such a sequestrum is a continued source of irritation as long as it remains *in situ*, and its presence will considerably modify the course of the disease. Small pieces of bone will in time become disintegrated, and partially or entirely dissolve in the abscess, but larger portions may remain for years, and give rise to a great deal of trouble.

The modern plan of freely opening an abscess enables us in some instances to explore the seat of bone disease, and perhaps to remove such a sequestrum.

Suggestions for operation with a view to remove this source of irritation have from time to time been made. Furneaux Jordan was one of the first who proposed cutting down by the side of the spine with this object, and subsequently McEwen, of Glasgow, introduced a plan of opening up a psoas abscess both in the loin and groin, exploring the seat of disease, and removing sequestra of bone. Treves performed the same operation, and inserted a large drainage tube from one opening to the other.

The latter operation was performed as follows.

Details of operation.—A vertical incision is made near the outer edge of the erector spinæ; the sheath of that muscle and the quadratus lumborum are cut through; the psoas muscle is incised and the vertebræ reached by continuing the operation along the deep aspect of that structure. Necrosed bone can be removed through this opening, or an abscess evacuated in its early stage. Should there be a psoas abscess

extending to the groin, a counter-opening can be made there, and a large drainage tube be passed between the two.

Such operations ought to be reserved for very exceptional cases, and the continued drainage in this fashion has been superseded by the more recent operations already described.

The locality which can be thus operated on with much chance of success is limited to the lumbar region, for in the dorsal the ribs seriously interfere with its successful performance.

Yet even in the dorsal region operations have been performed.

Dr. Boekel describes in *Schmidt's Jahrbücher*, March 14, 1883, a case in which he removed portions of the bodies of two dorsal vertebræ with good results. He stated that he did not find it very difficult. Resection of 1 to $1\frac{1}{2}$ inch of one rib gave enough room to introduce a scoop. The abscess generally makes a space lessening any danger of wounding large vessels in front of the spinal column.

Laminectomy, or the removal of the arches of the bones in the situation of the disease, seems to promise another means of removing necrosed bone and tubercular deposits. I have already described this operation above.

CHAPTER VI.

THE PERIOD OF TREATMENT.

The length of time during which treatment must be continued before we can expect the disease to be cured, and also the time when the patient will be able to dispense with mechanical support, are points of very great importance, in which every patient, or his parents or friends are greatly interested.

The decision upon these questions depends very much upon the peculiarities of each case.

We may consider the subject from two points of view:—

1. *Period of consolidation of the diseased bones.*

2. *Period of time during which it will be necessary to continue mechanical support.*

1. Period of consolidation.

The three chief items for consideration are:—

(*a*) General health of the patient.

(*b*) Extent of the deformity.

(*c*) Progress of the case.

(*a.*) I think it may be laid down as a rule that, given a patient who is apparently robust, and in whom the disease is presumably a local affection, and where the degree of deformity is moderate (see fig. 1), the shortest time in which we may expect complete consolidation of the diseased vertebræ is one year. I would consider this year to commence at the time of complete cessation of pain and all other active symptoms, such as high temperature or spasmodic contractions of the limbs. This is the most favourable result, as regards time, we can expect in ordinary cases, the only exceptions being perhaps in cervical caries and in some cases of lumbar caries.

In case No. 118 (cervical caries), a cure seemed to have been brought about in six months, but I doubt the expediency of acting upon such a result.

Upon commencing treatment we depend much upon the thorough carrying out of our directions, and it not infrequently happens that directly pain has been subdued, and all acute symptoms have subsided, the patient believes himself nearly cured and able to return, to a great extent, to his more active occupations.

If this course be taken some of the former symptoms return, and many weeks or a few months may pass before he realises the absolute necessity of greater care.

Here, the commencement of the year must date from the period when the patient has learnt how to modify his movements, and to so adapt his habits that pain and other acute symptoms are absolutely subdued.

In some instances, from the commencement of treatment, notwithstanding our utmost efforts, and the utmost efforts of the patients, it will be several weeks or longer before we can subdue the active symptoms.

During progress towards recovery many things may happen to retard the improvement, an illness, a sudden slip or fall, a severe shaking in a carriage, or a sudden twist of the body, as in turning round quickly. Any of these incidents may seriously prolong the period.

There is a great difference in patients. Some will readily adopt the principles of care, maintaining a rigid spine whatever they may be doing; going about with caution and steadiness; doing everything in a deliberate manner; never sitting down in a chair suddenly with a jerk; never looking round quickly; never bending forwards energetically.

These patients may take plenty of exercise, moving about freely, but always discreetly and carefully, always keeping their spines rigid, being guided by the action of the supporting apparatus, and never trying to resist it.

Others do not take readily to these habits. They are too graceful in their movements, too spasmodic in their dispositions, and are frequently bringing back pain or discomfort by their inconsiderate actions. Then we meet with individuals, and they are numerous, who are ever wanting to test their progress; just trying if the pain can still be produced by some particular movement, and never contented to keep from all actions which have previously produced discomfort.

These irregularities may retard the progress of consolidation,

and thus prolong the period of cure. The patients with whom we have the greater difficulty are those who suffer little or no pain; with them we must use our discretion as to their actions.

If we consider the period of a year as the shortest time in which a robust patient can get well, so we must increase that time in accordance with the general deterioration of the patient's health. When there is general tuberculous infection, the ultimate result must obviously depend upon subsidence of the general symptoms, or, in other words, upon the improvement of the patient's constitutional condition.

Notwithstanding the truth of this assertion, we often see carious spines consolidate, although tubercular disease is progressing elsewhere. Tubercular meningitis may cut off a patient in whom good progress has been made as regards the caries, and we may even find consolidation of carious vertebræ in patients who die from this or other tubercular disease. When tubercular disease has become general, it is useless to discuss the length of time necessary for consolidation of a carious spine, the general health of the patient being of the first importance.

(*b*) *Extent of the Deformity.*—If the spine is thoroughly supported, and there is a moderately severe angular deformity (other symptoms being favourable), we may consider a year a fair time for consolidation, but if there be indications of a great loss of bone, and especially if the rigidity has given place to undue flexibility, then we know that a space exists which has to be filled up (see Case 1, p. 121); then we know that several years must elapse before the repair can take place, and the new bone become perfectly consolidated. In such a case the surgeon may consider it desirable to try and approximate the diseased bones, but I do not think this would be a judicious thing to do. Sometimes a patient has done this for himself, and produced a terrible deformity, as shown by fig. 36, from a specimen in St. Mary's Hospital Museum.

This approximation of the diseased bones might expedite the period of consolidation, but we can hardly suppose that anyone, in order to save a few years of care, would submit themselves to an increase of deformity, even to a much slighter degree than shown in that figure.

(*c*) *Progress of the Case.*—Whatever our opinion as to

period of time may be, upon commencing treatment, we ought to be always ready to modify it in accordance with the progress of the case. Experience teaches the surgeon to be most guarded in giving a prognosis as to time. In a very favourable looking case there may be a large abscess existent which is gradually approaching the surface, and which will ultimately have to be opened.

Abscesses may greatly prolong the period of treatment, so that no definite period can be safely depended upon. It may be further stated that other complications, such as paralysis, will necessarily prolong the period before a recovery can be expected.

2. The period of time during which it will be necessary to continue mechanical support.—This must depend upon the degree of deformity. It is obvious that until complete consolidation of the diseased bones has taken place, and all symptoms have disappeared, the apparatus must be worn.

When perfect consolidation is assured, the further use of the support will depend upon whether the spine is sufficiently upright or not to support the body without the latter giving way from its mechanical inefficiency. In such instances as Case 142, p. 140, the deformity is so considerable that some support will always be needed if an increase is to be prevented. Under these circumstances, the patients feel so much comfort from wearing the apparatus that they do not think of giving it up.

It is not the part of the spine which was diseased which would give way, but the sound parts above and below.

In slighter degrees of deformity it depends upon the strength and activity of the patient, whether he can maintain his erect position or not, without his support. Sometimes a partial wearing of it, say every other day, or once a week, or when laboriously employed may be desirable, or a more simple apparatus may be used.

CHAPTER VII.

CASES.

The following cases are selected from my list of patients affected with caries of the spine. (In some instances I have named the hospital where a plaster of Paris jacket has been applied, the object being solely to show that the appliance had been put on with due care and skill.)

Case 1.—January, 1882. Recovery from very severe and extensive disease. The existence of a large space from complete loss of the bodies of three vertebræ, and partial loss of the bodies of several others above and below. Repair, by deposit of new bone.[1]

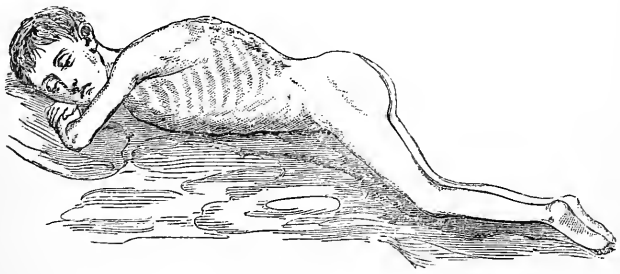


Fig. 68.

Represents the appearance of the patient (Case 1) in January, 1882, almost lifeless, and with the lower extremities paralysed.

A. W., a boy, aged 8, who was so ill when I first saw him that it seemed impossible he could live for more than a few days. He was in an extremely emaciated condition, and suffered great pain upon the slightest movement. He had been getting gradually worse for five years. The disease was

[1] Recorded in *British Medical Journal*, March 19, 1892.

attributed to a fall. *He had been treated for six months by the application of plaster of Paris jackets carefully applied at one of the general hospitals, but this treatment was not successful,* and the patient had been in constant pain while wearing the jackets as well as subsequently.

Abscesses, both lumbar and psoas, existed on both sides. His legs were partially paralysed (it was twelve months since he could walk).

He had been supporting himself day and night for six months upon his arms and knees in the prone position, his mother not being able to persuade him to rest in any other way.

Fig. 69.

Represents the patient (Case 1) improved in condition and walking about, September, 1883.

On January 11, I fixed his spine in the manner already described. At that time the slightest movement of the body caused great pain, and the appearance of the back when such movements were made, gave the idea that it would require

very little force to break the spine completely. I believe there was little or no attempt at repair of the bones at that time.

On January 13, I found the patient very comfortable and able to turn in bed for the first time for a long period. I then placed him on a prone couch, which he greatly appreciated. Many complications arose which required attention and frequent alteration in the adjustment of the instrument. He gradually rallied.

My report, September 3 (eight months later), states :—"He can now walk about comfortably, the abscesses are healed up and the health has improved in every respect; destruction of bone seems to have ceased from the time of commencing this treatment."

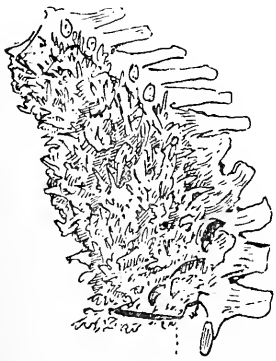


FIG. 70.

Appearance of spine with new bone filling up the cavity formed by the caries.

FIG. 71.

Shows the amount of destruction of bone, the new bony growth having been broken away during preparation of the bones.

There was no record of tubercle in the history of the patient or his relatives.

He continued to get about, and improved in health in every way until September, 1884, when he died from tubercular meningitis.

Fig. 68 shows his appearance when I first saw him.

Fig. 69 shows him as he appeared in September, 1883, twenty months later and a year before his death. This patient's health was evidently undermined from the long continuance of

the disease before his spine was thoroughly fixed, and it seems probable that deposits in the membranes of the brain took place during the period of extreme emaciation.

One important point elucidated by this case is the possibility of the filling up of so large a gap as shown in Fig. 71.

It has usually been thought that such repair is impossible, and that it is important in the treatment of caries of the spine to allow the bodies of the vertebræ to sink together, and so enable the repair to take place.

Fig. 70 shows the growth of new bone filling up the vacant space, and yet not encroaching upon the spinal cord.

The diseased part of the spine appeared at the *post-mortem* examination to be perfectly solid bone in a stalactitic form, but upon its being cleaned by the museum porter most of this new bone crumbled away, showing that it had not yet attained perfect solidity, although it was sufficiently strong to support the body and allow the patient to get about without discomfort.

Fig. 71 shows the appearance of the bones subsequent to maceration.

This seems to prove that when such a severe case is restored to health it requires several years before the new growth of bone can be quite strong.

Case 23.—August 28, 1883. Miss T., aged 26, had severe disease centred in the first lumbar vertebra. She had worn a felt jacket, without which she could not walk, or sit up, but even with this assistance she felt much pain, and was in a very unsatisfactory state of health.

The application of the apparatus advocated above soon gave perfect relief, and a month later this patient felt so well that she returned to her work.

Case 30. — February 19, 1884. Master C., aged 15½. Disease was centred in the twelfth dorsal and in the lumbar vertebræ, and had been getting worse for two and a-half years. A plaster of Paris jacket had been put on eight months previous, and worn for four months, but abscesses came, and it had to be discontinued.

Notwithstanding the abscesses it was quite easy to apply the metal splint, which gave great relief at once, and by means of this and other treatment, the patient made as good a recovery as his tuberculous condition allowed.

Case 31.—April 4, 1884. Pain chiefly on one side.

Mrs. R.'s daughter, aged 7¼. Very healthy child until the age of three, when in skipping she fell and her hoop struck her back, from which time she complained of backache. Eight months after the accident a small projection began (at the twelfth dorsal vertebra), which was not thought serious. The patient got gradually worse and the nature of the disease became evident, and on November 7, 1882, a plaster of Paris jacket was put on at Ormond Street Hospital, and this one jacket kept on for ten months. When first put on the jacket gave some relief to the pain, but it felt tight and interfered

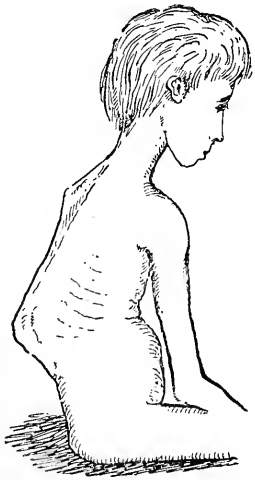


FIG. 72.

Appearance at first visit.

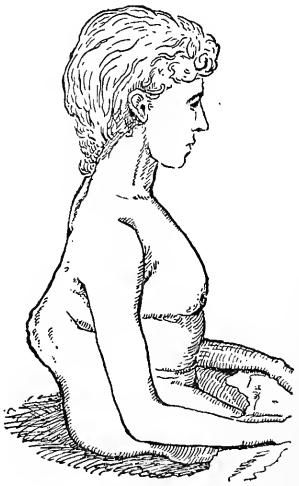


FIG. 73.

Appearance in 1892, the chest having been developed by the treatment.

with the breathing, and the patient felt distressed by it. She soon began to get thinner. The appetite was always bad while under this treatment, and she always complained of the weight of the jacket. When the plaster was removed it was found that the deformity had greatly increased. Since then she had continued to get thinner and suffered much pain, especially in the left lumbar region.

On April 10 I applied the "adaptable splint," from which

the patient derived comfort immediately. All pain left her in less than a fortnight, and she rapidly improved both in health and as regards the position of the spine.

Case 34.—May 20, 1884. Caries centred in the lower two dorsal and upper two lumbar vertebræ.

Miss M., aged 19, a very delicate, scrofulous-looking girl. Eight years ago she first felt pain in the back, which had gradually increased. The pain was worse when moving and stooping, also upon lifting the left knee. Pain in the back constant, except in the morning after a night's rest. The

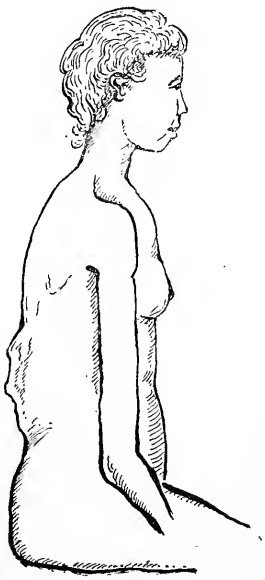


Fig. 74.

patient was dependent upon her needle for her living, and could hardly work at all. Was contemplating giving up work and returning to her home in the country. I applied an instrument which gave immediate relief, so that her work was continued in comfort. After three weeks all pain ceased.

The patient improved in general health and robustness. I saw her occasionally up to September, 1886, and she continued quite well and free from pain.

Case 40.— November 6, 1884. Caries at birth.

Child, aged 13 years. Caries centred in the second lumbar vertebra. A small projection in this region was noticed at birth. The mother had had a fall downstairs a month before the child was born. Projection gradually increased, and at the age of three got rapidly worse. At the age of seven, an instrument maker's support was put on which was uncomfortable, but served to lessen the rate of increase of deformity. Upon adopting the plan of treatment here advocated the result was satisfactory. I refer to the case chiefly as an instance of very early caries. Erichsen mentions a case where he thought that caries had been induced by slapping a newly-born infant to make it breathe.

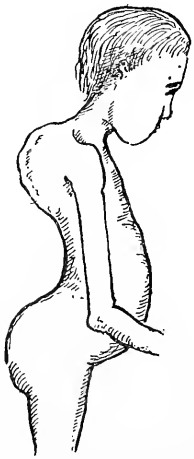


Fig. 75.

Case 42.—Very severe case. Two years' paralysis. No pain. Perfect recovery.

Master W., aged 10, was brought to me on December 2, 1884, with caries in the upper dorsal vertebræ. (See fig. 75.) At the age of three he had suffered from disease of the left hip-joint, following a severe fall. The result was ankylosis of the joint in a flexed position, at right angles with the body. Consequently, when he walked it produced severe lordosis.

At the age of $8\frac{1}{2}$ (one and a-half years before I saw him), a doctor found a projection of the upper dorsal vertebræ. The patient was then getting about on crutches for the hip disease. He had had a fall a few months previous. Two months after the discovery of the dorsal projection he rapidly lost power over his legs and ceased to walk. He had not been able to use his legs since. He lost control over his bladder and subsequently over his bowels, *but he had never had any pain in connection with the spine.*

There was an abscess on the right side of the neck. Sensation in the legs was dull up to the groins. His control of the movements of the legs was absolutely lost, but the legs contracted involuntarily.

December 9.—I applied an instrument, and the patient was placed on a prone couch.

January 6, 1885.—He was better generally.

January 13. — Some slight power over the legs had been regained. He felt the passing of a catheter, which he did not on January 6. There was increased sensation in the skin of the legs.

January 22.—Power over the bowels was increasing, also sensation in the legs, and he felt the catheter more.

April 2.—Better in all respects. Abscess in the neck had closed after repeated injections of solution of carbolic acid. Power over legs had increased. He could raise his right thigh. Knew for the first time when he wanted to pass water.

May 7.—Better. The left hip being ankylosed the movements of the legs caused movement of the spine. I, therefore, had the instrument extended down to the thigh as in hip-joint disease.

June 24. — Finding the power in the legs so much increased I placed the patient on his legs, and he was able to stand unsupported, *being the first time for more than two years.* A few weeks after this I allowed him to take a few steps and subsequently to walk across the room once a week.

September 6.—He was getting on well, walking a little every day, having complete control over the bladder, but still not able to wait long. Fairly good control over the bowels, but could not wait.

He continued to improve, and I have seen him up to the present time (December, 1893), walking about perfectly well, with the exception of the disability caused by the deformity.

Case 49.—June 30, 1885. Caries centred in the tenth and eleventh dorsal and first lumbar vertebræ. (See fig. 76.)

Miss F. P., aged 10. Disease appeared five years previously, after whooping cough and measles. Slight projection in the back commenced four years previously. A felt jacket was applied, and up to the above date three different jackets had been made. The projection had been rapidly *getting larger all the time the jackets had been worn.* No restraint was put upon

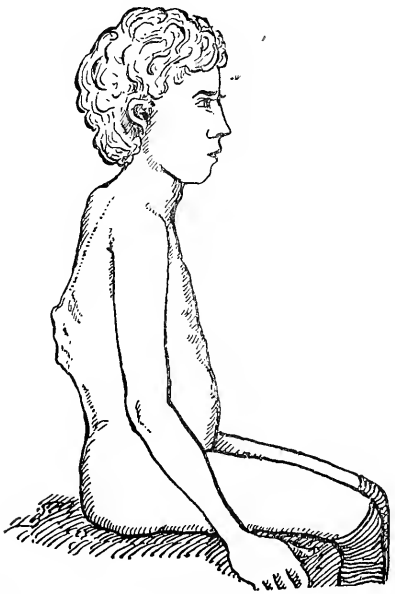


Fig. 76.

the patient's movements. The jackets were always uncomfortable. I applied an instrument which at once gave relief, and remained comfortable. The child improved in every way, in health and strength, and became quite upright, as shown in the figure. She was quite well in 1888, and I have heard recently that she continues well (1893).

Case 53.—October 5, 1885. A. C., aged 23. Four years previously, while carrying a pail, this patient strained her back,

causing sudden severe pain. Had not been free from pain since. Was getting gradually worse, and during the last twelve months had not been able to work. Pain was chiefly in the lumbar region. The fourth lumbar vertebra projected. The pain was increased by walking, she was very weak, with bad appetite and very short breath. The latter affected her much when going upstairs. There was palpitation of heart, pain in head, back, and neck, and inability to sit up.

October 12 I applied an instrument, and in a few days the patient felt very much relieved. In a few weeks all the pain had left her, and she made good progress, with the exception of temporary intermissions from want of adjustment of the instrument. About a year later she seemed to be perfectly well.

Case 54, Oct. 15, 1885. Very severe case. Good recovery.

Caries centred in the six lower dorsal, and upper two or more lumbar vertebræ.

Master H., aged 13, had been suffering about six or seven years. Had received very careful treatment, including several appliances for the back. When I saw him he was wearing a moulded leather splint, which took a fairly good bearing for such an apparatus. He was thin, but healthy looking.

A psoas abscess on the left side had been continuously discharging for five years. There were two lumbar abscesses in the region of the twelfth dorsal vertebra. The right one had been open for three and a-half years, the left one for two years. He was lying in the prone position, but almost flat, so that the lumbar region sank to an unnatural extent. Was very carefully nursed, but moved in many ways that disturbed his back.

Soon after I saw him a psoas abscess opened on the right side, which was immediately, with the others, treated by injection of solution of carbolic acid. An instrument was put on and he was placed on a prone couch of proper form. (See p. 96.) The profuse discharge which had come from these abscesses was rapidly lessened, so that in six weeks' time, the two lumbar abscesses had healed up. They subsequently opened again, and discharged a much thinner and very much smaller quantity of matter.

This tendency to close and open again has continued ever since, but during the last few years there has only been a very

thin watery discharge. The fact that these abscesses have not healed up entirely, seems to me to prove the existence of some necrosed bone at the seat of disease. This patient improved gradually, and for the last few years he has been walking about attending to his duties as a clerk. He plays cricket, jumps and runs, and does anything he wishes. He is very active and energetic, and does not trouble himself in the least about the discharge, or the deformity. I proposed some years ago to endeavour to cut down on the diseased part of the spine and remove the necrosed bone; but, as in every other way the patient was progressing satisfactorily, I did not press my suggestion, and both patient and his father preferred to put up with the small inconvenience.

Case 58.—Feb. 17, 1886. Sores caused by Plaster of Paris jacket.

Master B., aged 10. Caries discovered in September of the previous year. The following month a plaster of Paris jacket was put on at Westminster Hospital. This was changed for a second jacket, which latter had remained on ever since (three or four months). He had emaciated since then, felt very ill, had no appetite and suffered "just as much as ever." I removed the jacket and found the disease centred in the fifth lumbar vertebra. The surface was sore from the jacket, and there were several sore places on the body, on both sides of the back, and front of the chest. The whole skin was in a very irritable state. He was very glad to get free from the jacket.

He soon realized the comfort of the adaptable splint, and when I last saw him was rapidly progressing towards recovery.

It should be noted that any appliance may cause sores if not properly attended to, but such a result should not happen with a splint which allows the back to be seen while it is being worn, and which can at any time be modified in position so as to relieve any part unduly pressed on; but with a plaster jacket such a result may be unavoidable, as very frequent change is impracticable. Plaster jackets have often been kept on for several months with the sanction of the surgeon.

Case 73.—May 30, 1887. Caries in advanced age.

Mr. C., aged 67, had suffered from asthma for many years. About six weeks previous to above date, after very violent coughing he felt pain in the back, about the position of the

third dorsal vertebra. This pain had rapidly increased, and had extended from the situation named downwards and upwards and completely round his body, but it was always worse at the part first attacked. Although he stooped somewhat before, yet since the pain had occurred he had become markedly more bent in the back. Had lately been wearing a soft corset with lateral supports and crutches. I applied a splint, but it required a great deal of adjustment before it could be made comfortable. When, however, this was accomplished, the patient derived very great relief from his pain.

There was gradual improvement until, in a week, the pain in the back had quite ceased. He made steady improvement in every way, and in February, 1888, I received a note from him saying he had left off the instrument a few weeks and felt quite well and strong.

Case 83.—March 20, 1888. Prone position by choice.

A. M., a little boy, aged 4, had been treated by means of a plaster of Paris jacket, which he had worn for over six months. It relieved him somewhat, but when it was taken off, the deformity was found to be much worse.

This child adopted the prone position in bed of his own accord. I have no further notes of this case, and, I believe, I did not see him again.

Case 86.—June 5, 1888. Pain on one side only.

Mr. P., aged 28. This patient was a grocer by trade. Two years and three months previous to my seeing him he had strained his back lifting a heavy weight. The next morning he felt ill, and only got with difficulty into the next room. He felt acute pain in the loins directly he moved. The pain had continued in this region ever since. Ten or eleven days after the accident he returned to business and found himself quite unable to lift heavy weights, and could only get about to superintend his business. About three months before his visit to me he found for the first time a projection in his back. The pain was then chiefly in the left side of the spine.

On May 15 he had a plaster of Paris jacket put on, which remained on up to a few days previous to my seeing him. He looked ill and thin. His weight, which had been 142 lbs., had decreased to 132 lbs.

He had a phthisical look. A younger brother died at the

age of ten from consumption; two brothers and two sisters were still living, and were in good health. There was no other history of consumption in the family. The parents were both dead, ages 60 and 63.

On June 8 I applied an instrument with good effect.

On June 23 there had been no pain since wearing the instrument.

On October 1 he was very much better indeed.

This patient made steady progress towards recovery, and is now perfectly well.

Case 90.—January 15, 1888. Deformity produced by disease earlier in life. Improvement in figure and relief of discomfort.

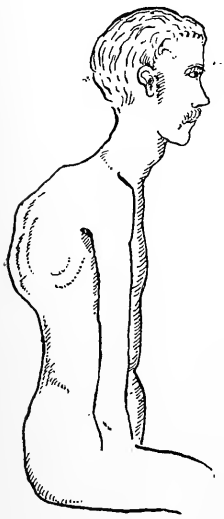


FIG. 77.
Before treatment, sitting.

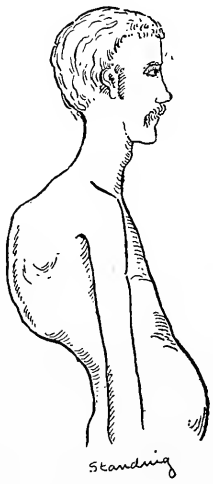


FIG. 78
Before treatment, standing.

FIG. 79.
Position improved by mechanical support.

Mr. K., aged 38. In this case there had been probably active disease which had ceased, leaving the spine with a considerable posterior curve. (See figs. 77, 78). The deformity had commenced fifteen years previous to the above date, and eight years subsequently he was made much worse by an accident, a heavy cart-wheel passing over his back and loins.

During the previous few years he had walked a great deal and played tennis, but felt considerable inconvenience from the position of the back, which troubled him very much. Suffered much pain in the stomach, which he attributed to indigestion Standing made him feel very tired, but this position was necessitated by his occupation.

On June 22 I applied an instrument with very good effect.

On July 19 he reported that he had no aching or pain of any sort. General health was better. The pain in the stomach had gone, and he could then stand at his work without getting tired. He has since greatly improved in figure.

On July 31 he had attained to the position shown in fig. 79. and felt in every respect better in health.

It will be observed that the centre of gravity of the head in fig. 77 is in front of the anterior surface of the thorax, whereas in fig. 79 his head is well behind this line.

Case 91.—July 3, 1888. Miss S., aged 7. This case was brought to me in consequence of an inclination to stoop. The symptoms then present were simply those of weakness, whereas it afterwards proved to be commencing caries.

It was one of those cases which are often treated by severe muscular exercises, and if that course had been pursued in this instance, the patient would certainly have been made worse, and disastrous results might have ensued. I considered the child was so weak that she required recumbency as well as a light support to the spine.

With this treatment she soon became perfectly upright, and her health improved, but subsequently symptoms of caries presented themselves, and she was treated for that disease in the manner already described. In this case the use of a prone couch was of very great assistance.

I have seen her from time to time up to the present, and she is now apparently perfectly well and strong; but as there is a considerable scrofulous tendency, I had thought it wise not to give up the support entirely hitherto, but have now (January, 1894) permitted this being done.

Case 93.—July 20, 1888. Caries mistaken for Hysteria.

Miss K., aged 17. Ten months previous she had twisted her back at a gymnasium in taking a high jump. After resting a few days she returned to the gymnasium, but every movement hurt her back. She went again a few days later, but some pain recurring, she gave up the gymnastics.

She suffered from constant pain in the lumbar region, but as there was no projection of the spine the symptoms were attributed to hysteria, and every attempt was made to induce the patient to pay no attention to her feelings. After a time, the pain not only occurred upon movement, but was felt at all times, and especially after walking much or sitting up.

Previous to her visit to me she fell to the ground in trying to sit down, the chair having been removed, and then the back was considerably shaken. She was then taken to Dr. Guillemard, who diagnosed symptoms of inflammation, and sent her to me.

The lower four dorsal vertebræ projected slightly. The patient was in very delicate health.

On July 26 I applied an instrument, and on August 13 she was very much better, the pain having left her.

On September 12 I learnt that no pain had been felt since her last visit, until the day before, when some aching occurred after taking a bath. After this, the pain was severe for some days and then subsided.

From this date the patient made uninterrupted progress to health, and about a year later gave up the instrument, being perfectly well.

Case 102.—January 17, 1889. Severe Caries treated by recumbency and a jacket, but the patient allowed to carry out gymnastic exercises before the Spine had become quite consolidated, with disastrous consequences.

Master B. R., aged $8\frac{3}{4}$. Family history perfectly good, five brothers and three sisters, all strong.

The patient was quite well until three and a-half years previous, when he injured his back, and caries supervened. He was laid up and treated by constant recumbency, and a felt jacket for twelve months. Got gradually better with a good deal of deformity. (This treatment often produces a cure, but nearly always at the expense of increased deformity.)

After this he got about, and a few months previous to his visit to me, he was allowed to do some exercises on a gymnastic bar, which disturbed the repair of the bone, and set up active caries again. When I saw him he had the peculiar grunting respiration which I have already described, pain in the left side only, in the course of the nerves from the affected vertebræ.

I applied an instrument, which he immediately realised as very comfortable. There was some improvement in the position of the vertebræ above and below the seat of deformity, and he seemed to be getting better.

Subsequently a psoas abscess appeared in the right thigh, a large quantity of matter was evacuated, and small spiculæ of bone came away in considerable quantities. From this period he got gradually worse. The cavity of the abscess was thoroughly syringed out every day, the tube passing 14 inches, apparently quite up to the seat of disease. During the long illness which followed he suffered a great deal of pain, and every few days pieces of bone came away. The surfaces of these pieces were quite smooth, and not carious like the pieces that usually come away in this disease. They were evidently pieces of new bony growth, which had been broken down by the exercises. He gradually got worse, and died from exhaustion on Feb. 26, 1893.

The fatal result in this case I attribute entirely to the fact that it was a secondary inflammation. The original inflammatory symptoms had ceased, and the repairing bone was broken down by the gymnastics commenced too soon.

The breaking down of this irregular mass of bone, must necessarily be a much more serious matter than the original caries, making it much more difficult or impossible to support the spine in a satisfactory position.

In the few cases that I have met with, where there has been a secondary inflammation of this kind, there has always been far greater trouble, in fact, almost an impossibility of obtaining a satisfactory result.

Case 105.—Feb. 12, 1889. Relief of inflammation by drilling into the spinous processes.

Miss M., aged 23. In this case there was a lateral curve to the left. The caries was centred in the sixth, seventh and eighth dorsal vertebræ, the spinous processes of which were much thickened and tender.

Mechanical support gave her great relief, but the pain in the spinous processes remained, and so I operated by drilling into these three bones, in the manner described on page 109.

There was considerable tenderness at the part operated upon for a few days, but after that all pain ceased. In January, 1891, this patient was quite well. She then married

and went out to the Transvaal. I cautioned her against too much hard work and rough travelling, but I had a letter from her subsequently stating that, although she had found the life much more severe than she expected, her back was getting on very well.

Case 110.—June 13, 1889. Severe bodily weakness from the period of childhood. Very rapid growth. Extensive range of the disease. Effectual, almost total removal of deformity.

FIG. 80.
Miss M., June, 1889.

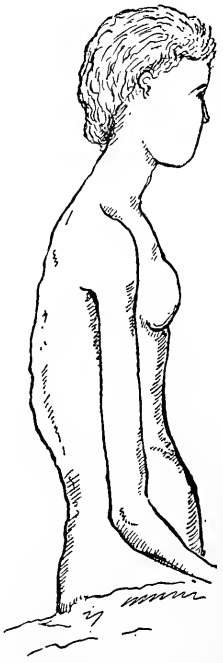


FIG. 81.
Miss M., June, 1892.

Miss M., aged 15½. This was a very unusual case. She suffered during infancy with severe bronchitis and congestion of the liver, and was only reared with the greatest difficulty. At the age of five she got weaker, and used to lose the power of her legs when tired. She stooped considerably, and this continued to increase during her growth. Eighteen months

before her visit to me, however, it became much worse, and she was then ordered three hours recumbency every day, and seemed to get better. During the previous autumn she had a severe attack of bronchitis. Fig. 80 shows the position when I saw her.

The whole spine was very rigid, entirely so in the neighbourhood of the prominent vertebræ, that is, from the sixth dorsal to the second lumbar.

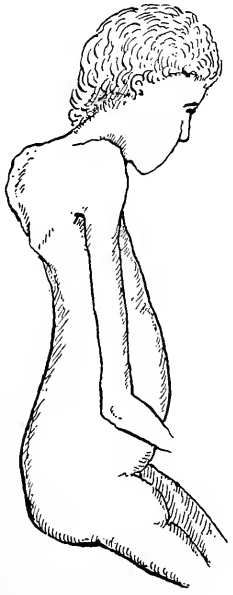


Fig. 82.
Miss A., July, 1889.

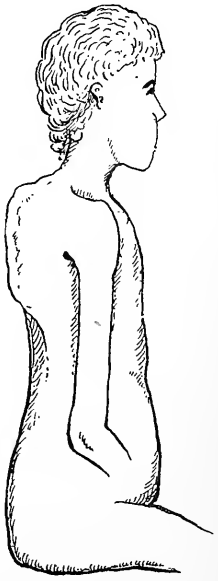


Fig. 83.
Miss A., Feb., 1892.

By the use of an instrument she was gradually, but very slowly, brought to an upright position, until in June, 1892, she appeared as shown in fig. 81.

She has gained a great deal of strength, and promises to become quite strong in the course of time, but it will probably take her at least another year (December, 1893).

This, I think, should be considered a very good result, taking into consideration the history of the case from infancy. She had long been looked upon as a permanent invalid, and it

was thought she must be a cripple for the rest of her life, which it was supposed would only be a short one.

Her height was as follows:—

October 9, 1889.—5 ft. $11\frac{3}{4}$ in.

March 7, 1890.—6 ft. $0\frac{1}{4}$ in.

May 7, 1890.—6 ft. $0\frac{1}{2}$ in.

June 11, 1891.—6 ft. $0\frac{5}{8}$ in.

May 17, 1892.—6 ft. 1 in.

She must have been much shorter when I first saw her.

Case 113.—July 26, 1889. Figs. 82 and 83.

Miss A., aged 7. This child had a history of tuberculosis, and there were many members of the same family who had also suffered severely from the same disease.

She was quite paralysed in the legs when I first saw her. She made very good progress, and when the activity of the disease had ceased, and she had regained power over her muscles she was unable to walk in consequence of the contraction which had taken place in the legs.

I divided the tendo achillis of each foot, and a few weeks subsequently set her on her feet.

She has been walking daily since then up to the present time (December, 1893). Considering her delicate constitution, great care is yet taken that she should not do too much.

Case 118.—November 14, 1889. Spasmodic Wryneck from Caries.

Mrs. P., aged 40. Six months previous she had first felt spasms in the neck, and soon afterwards had an inclination to turn the head towards the right side from contraction of the left sterno-mastoid muscle. Treatment by tonics, blisters, and other measures had done no good, and then she underwent twenty-three applications from a galvanic battery which made her feel much worse. The characteristic manner in which she held her head, and the pain at the back of the neck, all indicated a condition of caries.

The patient was quite unable to hold up her head, chiefly from the feeling of weakness, and not from spasm.

When this patient first came to me I was watching a case of spasmodic torticollis without caries, and it was very instructive to see the different appearances that the two cases presented.

These differences have been already described on page 40.

After six months' careful mechanical support, the patient felt perfectly well, gave up the instrument, and a few months later was remaining quite strong and well.

Case 142.—April 11, 1891.—Very severe case.

Esther B., aged 19. This patient was quite well until twelve months previous to the above date. Three months later some one struck her on the back which gave her great pain at the time, and the pain had never ceased.

Two months later the angle of deformity began to appear.

She had then great difficulty in breathing, but went on working in her mother's house, acting as general servant. At last she became so ill that she could work no longer, and had to take to her bed.

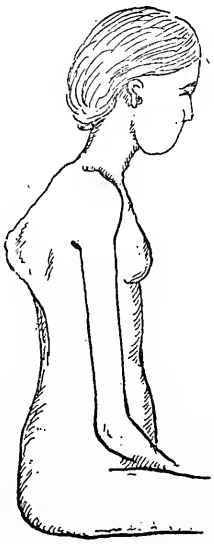


Fig. 84.

Menstruation had ceased about four months previously. Five weeks after the injury, a plaster of Paris jacket was applied at the Westminster Hospital, at which time she caught a severe cold and cough, which had remained with her ever since. From the jacket she felt some slight relief to the pain in her back, but none to the pain in her chest, and no other relief whatever.

Had been rapidly getting thinner, and had entirely lost her appetite. The plaster jacket being uncomfortable was removed.

She had been laid up at home, and the journey in a cab to my house increased her suffering very considerably. She was so bad that I thought she would have died during her visit. Her face looked like that of a corpse, the heart sounds were scarcely audible, and she had to be propped up in her chair. I gave her brandy and extract of beef, while I applied an old apparatus that I had at hand. This at once relieved her, and her pulse soon returned. A few days later I put on a suitable instrument. The legs became entirely paralyzed, both as regards motion and sensation. There was no feeling below the hip-joints and groins. She suffered from a great deal of pain in the epigastrium.

This patient made steady progress towards recovery; and on November 25 I noted that she had been free from cough for the last four months.

The legs were improving in power, the patient being able to lift both knees when sitting, and to move the feet. Sensation was also returning.

The constant pain in the back and stomach from which she had suffered had ceased soon after putting on the support. During the last few weeks she had regained power over her bladder, which she had also partly lost.

The spasms from which she used to be much troubled in the legs had ceased.

Menstruation had returned in July.

On December 30 she was looking quite robust and well; felt well and free from pain.

She could now stand by placing a hand upon the table.

I have seen her at intervals up to the present time (December, 1893), and she is apparently perfectly well, able to walk about and do anything that I will allow her, but I have advised care for the present, and avoidance of lifting weights or doing much work.

Case 152.—October 3, 1891. Very severe and complicated case.

Mr. P., aged 18. This was also an extremely severe case, and one in which all hope of his recovery had been given up, and the reason for having further advice was a question

whether something could be done to relieve some of his severe pain. Seven years previously he had suffered from rheumatic fever, which occurred again a year later, leaving his heart in a very weak condition. For two years after this he had to be carried up and down stairs, and went out in a bath chair. He then got about for nearly a year, not suffering from the heart, except that it prevented him from running. Had pleurisy in June, 1890, followed by influenza and congestion of the lungs, then pneumonia. Supposed to have some affection of the liver.

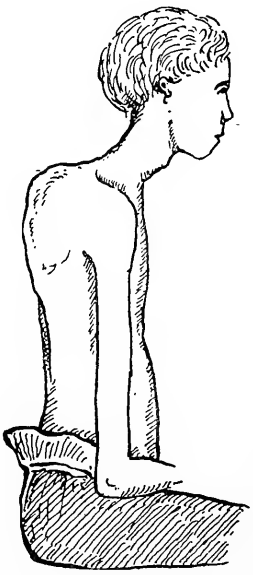


Fig. 85.

I could find no signs of organic disease, either in the heart or lungs, but the liver was much enlarged. I gave a favourable prognosis, although certainly his health had been greatly undermined by the disease.

I attributed the trouble of the heart chiefly to the effect of the caries. I applied an instrument with a head-piece.

On December 10 I note—"Has been very much better since

last visit. The pains in the epigastric region have been almost entirely absent, but he has had some pain in the right shoulder."

A readjustment of the instrument made him feel quite comfortable.

This patient also made steady progress towards recovery. In two months after the commencement of treatment all pain had ceased, and when I saw him in November, 1892, he seemed perfectly well, and able to get about, and do anything he wished.

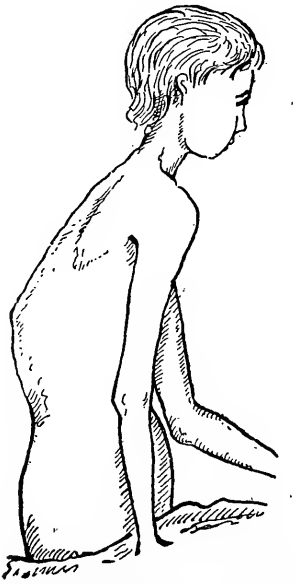


Fig. 86.

In September, 1893, I saw this patient again; he seemed quite well, and had not used the head-piece much for some months. All active caries seemed to have ceased; but from the severity of the angle of deformity, the want of support to the forehead had allowed the head to sink somewhat lower (fig. 85).

Case 166.—June 13th, 1892. Miss E., aged 8. During the last few months the spine had been noticed to be projecting

backwards, and gradually getting worse. Was very easily tired. Stooped very much in sitting as shown in fig. 86.

By the appearance of the spine and the general symptoms there could be no doubt this was a case of caries, but for some months the diagnosis had been somewhat doubtful.

At the present time (September, 1893) she is perfectly upright, apparently quite strong in the back, with no sign whatever of any projection of vertebræ.

Case 168.—July 8, 1892. No Pain.

Master B., aged 9. Three and a-half years previous this boy began to droop his head, and gradually got worse.

FIG. 87.

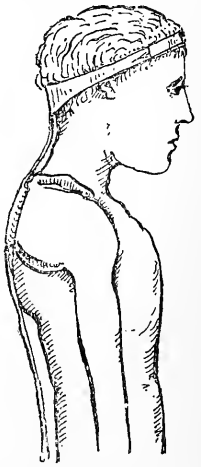


FIG. 88.

Master B.—Before and after application of apparatus.

Two years ago he used to complain of some pain in the shoulders when he came downstairs in the morning, but it was very slight, and since then he has not complained of anything. He was very active, running about all day. General health excellent. His father is a very strong man, and has four children younger than this one all well and strong. The only history of an accident is a fall out of bed at the age of about five years.

Case 188.—February 2, 1893. Miss L., aged 23. This patient was a nurse. Two years previous while lifting a very heavy woman she hurt her back and felt much pain for a week afterwards. Then she felt all right until, (my notes state), "a few months ago, when the pain began to trouble her again and

gradually became constant until the last few days, when she has been obliged to lie up in bed, and that has given her great relief."

By means of an apparatus I got her into a much straighter position. The pain soon subsided, and when I last saw her she was making rapid progress towards recovery.

Case 211.

Miss S., aged 26, came to me on October 12th, 1893. She had suffered from her spine for about ten years, but during the last two years it had been much worse, and her whole health had given way.

She had had several plaster of Paris jackets applied, and was wearing one when she came to me. Her chest was much depressed from her head and shoulders drooping forwards, a position which the plaster jacket does not prevent. She was suffering very considerably from impeded respiration, and had great difficulty in walking, and could never get about at all without pain in the back. She described herself as feeling (as she looked) very ill. She stated that she was quite unable to hold herself up without a jacket. With some difficulty I removed a very heavy plaster of Paris jacket, weighing over four pounds. We were obliged to hold her up beneath the arms, or she would have collapsed entirely. I happened to have by me a support which I put on temporarily, and this enabled me to examine the case deliberately.

There was a lateral sigmoid curve, the dorsal region bending to the left and the lumbar to the right. There was no angular projection.

Notwithstanding the absence of the characteristic deformity, I thought from the general symptoms that this was a case of active caries. I found the temperature nearly 100°, and this fact strengthened my opinion.

A week subsequently the patient was relieved in every way; she had lost her anxious appearance, felt better than she had done for many months, could walk much better, and the temperature had subsided to normal.

Case 204.

I was called to see Miss E. H., aged 16, on August 9, 1893. She was a very delicate and tuberculous-looking patient. She began to feel severe pain in the lumbar region five months previously, and had been getting gradually worse. She felt

better after a night's rest, and very much worse after walking any distance. She had recently been attacked by influenza, which had made her in every way worse. Temperature had been ranging between 103° at night and 102° in the morning during the fortnight previous to my seeing her, and Dr. Seton had at first feared typhoid or some other severe fever. (See chart, p. 38.)

I applied an "adaptable splint" upon August 16, and, as it will be seen by the chart, the temperature began to improve at once, the patient at the same time feeling less pain.

The patient gradually improved, pain left her, and, in accordance with this improvement, it will be seen that the temperature decreased.

Conclusion.

The chief points which I have endeavoured to show in the foregoing pages are :—

That caries of the spinal column, although a disease which endangers life, is one which is generally curable if treated with great care and patience before the health of the patient has been undermined by the disease.

That if the treatment is effective there need be no increase of deformity after perfect fixation of the spine has been accomplished.

That the symptoms may vary greatly, and be obscure, so that correct diagnosis may be difficult.

That the most important point of treatment is the mechanical fixation of the spine, and that considerable attention to the details of this fixation is necessary.

That general rest of the patient, carefulness in nursing, and assiduous attention to complications are necessary adjuncts to the successful treatment of these cases.